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ORIGINAL

MTADS UNEXPLODED ORDNANCE OPERATIONS AT THE BADLANDS BOMBING RANGE

PINE RIDGE RESERVATION
CUNY TABLE, SOUTH DAKOTA
JULY 1997

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CONTENTS

FIGURES

TABLES

EXECUTIVE SUMMARY

In July of 1997, the U.S. Naval Research Laboratory, with technical support from the U.S. Army Corps of Engineers, Huntsville (CEHNC-OE), conducted an unexploded ordnance (UXO) survey and remediation at the Badlands Bombing Range (BBR) (on the Pine Ridge Reservation in South Dakota) as part of an ongoing Technology Demonstration for the Multi-sensor Towed Array Detection System (*MTADS*). Funding support was provided by the Environmental Security Technology Certification Program. This survey demonstrated the performance of the *MTADS* in support of a remediation effort at a live site characterized by a range of ordnance and ordnance-related scrap and clutter (also called ordnance explosive waste (OEW)). In discussions with Mrs. Emma Featherman-Sam, Director of the Badlands Bombing Range Project at a site visit on April 25, 1997, it was confirmed that using the *MTADS* to perform a survey would benefit the Native American community. Moreover, this joint exercise between NRL and CEHNC-OE permitted the U.S. Army Corps of Engineers to evaluate the *MTADS* technology for use in buried ordnance site characterization of formerly used Department of Defense (DoD) ranges. In addition, potential benefits to the DoD are derived by using a state-of-the-art UXO detection system as a quality control check on portions of a range that had been previously cleared and certified as clean by the DoD using older technology.

Initially, an already surveyed area that included a range of targets and clutter was selected. The targets in this area composed the site training data set. All 89 targets in this set were dug and evaluated. This information guided selection of targets for remediation for the remainder of the demonstration. The site survey was conducted in a manner that permitted immediate analysis of data, providing position, depth, and size information for each target detected. Following target analysis, UXO contractors and UXO personnel from CEHNC-OE waypointed and remediated the selected targets to evaluate the detection, location, and discrimination capabilities of *MTADS*.

The survey was conducted over a one-month period, with about 65 hours of actual survey time. Although weather conditions were less than ideal, the *MTADS* surveyed over 150 acres at two locations, designated BBR I and BBR 2. BBR I is a highly visible circular target composed of a 500-ft-diameter circular earth berm (3 to 5 ft high), with a cross-hair berm inside the circle. This bull's-eye was used primarily as a bombing target.

The precise location of BBR 2 was unknown, with no visible features from either ground or aerial perspectives. Using only anecdotal information, the *MTADS* surveyed the area and successfully located and analyzed BBR 2. The type of ordnance found indicates that BBR 2 was used for practice bombing and more heavily as an aerial gunnery target. At BBR 2, 255 targets were dug, including an additional 17, M 38, 100-lb practice bombs. Targets selected for remediation on BBR 2 focused on smaller ordnance. A total of 28 subcaliber aerial rockets (SCARs) and 11 intact 2.75-in. rocket warheads were recovered. Many more fragmentary rockets and warheads were remediated. The aluminum bodies and fin assemblies on the 2.75-in. rockets do not survive impact, and low-order detonations from residual propellant on impact fragmented many rockets. More than 95% of all dug targets were located with a positional accuracy of less than 29 cm; the overall average positional accuracy was 12 cm. Average depths were correct to within 20% of the value calculated by the *MTADS* Data Analysis System. *MTADS* survey products were prepared in formats suitable for integration into the Intergraph Geographic Information System (GIS) database at Huntsville and the Arc Info/Arc View GIS databases at the Badlands Bombing Range Project Office.

The BBR surveys further demonstrate the ability of the *MTADS* to successfully characterize sites contaminated by UXO and OEW and to provide real-time support for a parallel remediation effort, while providing quality control data for both the survey and remediation activities. Over 1200 targets were detected and analyzed at BBR I and BBR 2. Of these, approximately 400 targets were chosen for remediation. Of the 146 targets dug at BBR I, 70 were M 38, 100-lb practice bombs, and four were sand-filled M 59 GP bombs. About 10% of these targets had intact black powder spotting charges, which were detonated in place. In addition, three 2.25-in. SCARs and one 2.75-in. rocket warhead were remediated.

Cost analyses were developed to document the operational costs to deploy the *MTADS* for the demonstrations at Twentynine Palms, the Jefferson Proving Ground, and the BBR site. By making a number of assumptions, we prepared a comparative cost model for *MTADS* vs conventional "mag and flag" survey methods for a range of hypothetical ordnance surveys. We are confident that the *MTADS* represents a more cost-efficient and effective survey tool, particularly in scenarios where remediation is required.

1.0 BACKGROUND

1.1 Program Description and Sponsorship

Unexploded ordnance (UXO) is arguably the most serious and prevalent environmental problem currently facing Department of Defense (DoD) facility managers. Mitigation and remediation activities are often hindered by the fact that UXO is colocated with other environmental threats including ordnance explosives wastes (OEW), chemical wastes, and other toxic and hazardous materials. Not limited to active sites and test ranges, these problems also occur at DoD sites that are currently dormant and in areas adjacent to military ranges that belong to the civilian sector or are under control of other government agencies. UXO mitigation and remediation problems assume even more compelling proportions when DoD lands are classified as Formerly Used Defense Sites (FUDS) or Base Realignment and Closure (BRAC) sites. Land on FUDS and BRAC sites must be evaluated and remediated as appropriate and must be certified as suitable for the planned end use depending on the pending disposition. Oversight and evaluation of these processes involves non-DoD agencies including EPA; state, county, and local governments; and the civilian community.

Current techniques for UXO detection, site characterization, and remediation are very slow, labor intensive, and inefficient. Typical detection and characterization technologies involve handheld detectors operated by explosives ordnance disposal (EOD) or civilian technicians who must slowly walk across the survey area. This time-consuming and sometimes dangerous process, often referred to as "mag and flag," has been well documented as inefficient, as well as marginally effective. Many ordnance items are disguised by the presence of extensive surface clutter and frag (shrapnel) from ordnance operations. Large and deep ordnance targets are often not found, because either their footprints are too large to be "visualized" by the walking operator or their signatures are lost in magnetic disturbances associated with geophysical anomalies. Developing an image of a deep target, especially in a field of shallow targets, is most difficult for the handheld surveyor. The Multi-sensor Towed Array Detection System *(MTADS)* technology is designed to address these issues.

1.2 *MTADS* Technology Description

The Environmental Security Technology Certification Program (ESTCP) funded the Naval Research Laboratory (NRL) to develop and demonstrate a multisensor vehicular towed array system. The *MTADS* incorporates both cesium vapor, full-field magnetometers, and active, pulsed-induction sensors. The sensors are mounted as linear arrays on low-signature platforms that are towed over survey sites by an all-terrain vehicle. The position-over-ground is plotted using state-of-the-art real-time kinematic, also called on-the-fly, technology that also provides vehicle guidance during the survey. Using mature sensor technologies, NRL has also developed and integrated a data analysis system (DAS) to locate, identify, and categorize all military ordnance at its maximum probable self-burial depths. The DAS is efficient and simple to operate by relatively untrained personnel. In each phase of the *MTADS* design process, every effort was made to reduce the magnetic self-signatures of the tow vehicle and tow platforms. Accordingly, significant improvements have been realized with respect to signal-to-noise ratios.

The performance characteristics of the *MTADS* system were initially evaluated through a three-phase demonstration process that was specifically designed to serve as a comprehensive measure of system performance relative to the design specifications. The first phase was a "TECHEVAL" demonstration at NRL's Chesapeake Bay Detachment (CBD) to measure system performance against the system requirements and performance specifications and to generate a database of sensor responses to diverse ordnance items at multiple depths and orientations. The second phase was a demonstration conducted at the Magnetic Test Range at the Marine Corps Air Ground Combat Center (MCAGCC) in Twentynine Palms, CA, in December 1996. In the third phase, the *MTADS* was demonstrated at the Jefferson Proving Grounds (JPG) test site in January 1997, following the completion of JPG III commercial demonstrations. Because the latter two operations were conducted at remote facilities, they clearly established that the system was capable of being transported thousands of miles and collecting superior data sets. These field trials also provided preliminary data sets concerning logistics needs, spares requirements, and survey economics.

Subsequent to the completion of these initial technology demonstrations, the *MTADS* is currently being applied to real-world scenarios, with the dual purpose of providing state-of-the-art survey capabilities to the DoD, while continuing to gather cost information to use in life cycle cost analyses and to thus create a basis for technology transfer. This report summarizes the technical results obtained from a survey of two live sites known as the Badlands Bombing Range (BBR) I and 2, located on the Pine Ridge Reservation in South Dakota. In addition, preliminary cost analyses are presented and contrasted to alternative survey methodologies.

1.3 Objectives for the Badlands Bombing Range Survey

The DoD ESTCP determined that the *MTADS* would be demonstrated at a site on the Pine Ridge Reservation. In discussions with Ms. Emma Featherman-Sam, the Director of the Badlands Bombing Range Project (BBRP), at a site visit on April 25, 1997, it was confirmed that using the *MTADS* to perform a survey would benefit the Native American community. Moreover, potential benefits to the Air Force would be derived by using a state-of-the-art UXO detection system as a quality control check on portions of their previously cleared ranges.

This demonstration was conducted in conjunction with personnel from the U.S. Army Corps of Engineers, Huntsville (CEHNC-OE). The primary objective was to conduct an extended survey of sites within the boundaries of the BBR to evaluate the performance of the *MTADS* on a former ordnance training range. A survey of this type would be expected to encounter both intact ordnance and a range of ordnance scrap and clutter (i.e., OEW). Following target analysis, UXO contractors and personnel from CEHNC selectively remediated targets to evaluate both the detection and discrimination capabilities of *MTADS*. An initial set of targets (i.e., a training data set) that included a range of target types and sizes was selected; all targets in this set were dug and evaluated. This information guided selection of targets for remediation for the remainder of the demonstration.

To the extent possible, qualified members of the Oglala Sioux Tribe (OST) participated in the demonstration surveys to gain experience in the conduct of ordnance operations. A large pool of hazardous waste operations (HAZWOPR) trained and certified tribal members were available for these efforts. All survey results are being shared with the BBR Project Office to help accomplish their restoration goals. NRL established several Global Positioning System (GPS)-based, first-order survey points to allow integration of all survey data into the OST Arc Info/Arc View Geographic Information System (GIS) databases as well as correlation with digitized aerial photographic information available from the U.S. Geological Survey and other commercial sources.

The participation of personnel from CEHNC-OE permitted the Army Corps of Engineers to assess the suitability of the *MTADS* technology for characterizing buried ordnance sites at formerly used DoD ranges. *MTADS* survey products are prepared in formats suitable for integration into the Intergraph GIS database resident in Huntsville and appropriate for reanalysis using their "Knowledge-Based" target analysis system. A cost analysis database is being developed to document the approximate costs to reproduce the complete *MTADS* capability, and the operational costs to deploy the *MTADS* at the demonstrations at Twentynine Palms, JPG, and the BBR site (see Section 9.0).

Finally, some objectives associated with this demonstration related to goals developed by DARPA, the ESTCP Program Office, and NRL. A small reference site that is uncontaminated by ordnance was established and surveyed at the BBR. This background survey provided information that can be correlated with DARPA-established clutter sites. Following survey of the Reference Site, a range of inert ordnance was installed from NRL stores, and the Reference Site was resurveyed to provide information for signature calibration against the local geophysical background. In parallel with the demonstration survey and data analysis, remediation operations dug an extensive range of targets to the extent allowed by time and resources. The remediated targets were extensively documented, both to evaluate *MTADS* performance and to establish a magnetometry and pulsed-induction sensor signature database for both ordnance and clutter targets typical of this site. All remediated targets were reacquired by GPS to precisely determine position. They were photographed, and target sketches, descriptions, and orientations were recorded on an extensive dig sheet report. All data sets acquired at the BBR were archived for potential future use using analysis tools developed with support by the Strategic Environmental Research and Development Program (SERDP) and ESTCP.

1.4 Historical Site Information

In 1942, the Department of War annexed 341,725 acres of the Pine Ridge Reservation for use as an aerial gunnery and bombing range. This site is located in the southwest corner of South Dakota, with the largest part of the bombing range located in Shannon County, approximately 60 miles southeast of Rapid City. The BBR was a live-fire range for over 30 years and most recently was used as a training range for the Army National Guard. Accordingly, a considerable number of sites within the vast range were appropriate for this *MTADS* demonstration. Since 1960, portions of the land have been returned to the OST. In 1968, Congress enacted Public Law 90-468 returning 202,357 acres to the OST, setting aside 136,882 acres of formerly held tribal lands to form the Badlands National Monument, to be managed by the National Park Service. The U.S. Air Force still retains 2,486 acres of land within reservation boundaries. This area is being subjected to a military EOD surface clearance, which was ongoing during the NRL *MTADS* demonstration.

Requests were made to Mr. Dell Petersen at the Environmental Office at Ellsworth AFB for historical information relating to Air Force involvement in the setup and use of the BBR. We were told that extensive archival information on use of the site does not exist and that all their information had been provided to the OST at the BBR Project Office. Similar requests were made to Ms. Jill Solberg and Mr. Kirk Engelbart at the Omaha Regional Office of the Corps of Engineers, who were responsible for archival records searches on behalf of prior Corps' operations at the BBR. In response to this request, CEHNC-OE provided us a map designating, in general terms, probable target areas within the range.

Working through the BBR project office staff and with the Bureau of Indian Affairs (BIA) regional office in Pine Ridge, we obtained the majority of photographic and archival information relating to use of and remediation operations on the BBR. The OST believes that they have identified 12 to 14 targets that were used for bombing and aerial gunnery practice. Some of these are identified on historical aerial photographs while others are apparent during surface walkover inspection. Some of the sites are much less well documented, with the primary information coming from clusters of ordnance scrap on the ground or the presence of car bodies or other targets that show evidence of ordnance impact.

The most detailed written information available to us are ordnance recovery reports written following remediation activities conducted by Air Force EOD detachments. These reports from 1963, 1964, and 1975 document surface clearance operations associated with returning portions of the BBR to the OST and the National Park Service to form the Badlands National Monument (renamed the Badlands National Park in 1996). While the documents claim that the entire BBR was cleared, OST representatives feel that much of the activity was concentrated on areas that ultimately became part of the Badlands National Monument.

Documented ordnance recoveries at the BBR include aerial artillery projectiles (50-caliber and 20-mm rounds); incendiary, photoflash, and practice bombs; rockets; and ground-based ordnance, including mortars and howitzer-fired projectiles. The latter ordnance presumably resulted from Army National Guard training operations. Due to the nature of the prior remediations, it is likely that the range will intermittently require additional remediation operations for many decades.

2.0 ESTABLISHING SURVEY PROJECT SITES

2.1 Coordination with the Oglala Sioux Tribe

On April 25, 1997, representatives from NRL visited the BBR Project Office in Pine Ridge, SD, as a preliminary step in the selection of potential survey sites. Extensive discussions were held with Mrs. Emma Featherman-Sam, Director of the BBRP and Mrs. Robin White, Director of the OST Land Office. Because the demonstration at the BBR involves surveying a relatively small portion of the expansive range, the areas chosen as survey sites required careful consideration to maximize the probability of finding ordnance items associated with bombing and aerial gunnery exercises.

Additional important factors involve the ownership of the lands, obtaining permission from all parties with vested interests, and possible interference with local customs and events and with current land use practices. Extremely valuable information concerning the history of the site was obtained as was extensive written documentation on DoD operations on the range. Information was also obtained as to other requirements for tribal lands that were leased for agricultural purposes as well as tribal lands administered by the National Park Service.

2.2 Inspection of Potential Sites

Figure 1 shows the location of the BBR on the Pine Ridge Indian Reservation. In selecting survey sites, NRL gave primary consideration to those areas that addressed the priorities of the OST; secondary considerations were current land use and land ownership. Sites that are not administered by the National Park Service or under the control of the Tribal Land Office require permissions from a majority of all the descendants of the original land owners to conduct operations. This could require obtaining permission from several dozen current land owners for a specific privately held site. We toured several of the potential sites and observed some of the target areas. Considerable time was spent evaluating the Air Force Retained Area. The areas of most importance to the OST are various sites on Cuny Table (because of the relatively high value of the land and its probable future use by tribal members) and the Air Force Retained Area. The latter area is important to the OST because its final return to tribal control is an important unresolved issue more than 20 years after the Air Force has relinquished control of all other areas. Following the April 25 meeting in Pine Ridge, the tour of the BBR, and subsequent discussions with members of the BBR Restoration Advisory Board (RAB) and Ellsworth AFB representatives, portions of the Air Force Retained Area were chosen for the *MTADS* demonstration.

2.3 Coordination with Other Agencies

In order to establish the survey site and obtain the approvals of the interested parties, NRL convened a meeting of the BBR RAB, whose members are selected by the BBR Project Office, and representatives of NRL, the ESTCP Program Office, the Army Corps of Engineers, and Ellsworth AFB. The meeting was held on June 12, 1997, at the Environmental Range Office at Ellsworth AFB. The participants are listed below.

Participant	Affiliation
E. Featherman-Sam	OST, Director, BBRP Office
J.R. McDonald	Naval Research Laboratory
Herbert Nelson	Naval Research Laboratory
Richard Robertson	Hughes Associates (NRL)
Jeffrey Marqusee	Director, ESTCP
Thomas Altshuler	Institute for Defense Analyses
Jim Manthey	CEHNC-OE-CX
Jeff Neece	CEHNC-OE
Kirk Engelbart	U.S. Army Corps of Engineers, Omaha Office
Mario Robles	U.S. Environmental Protection Agency, Region VIII
Kevin Jacobson	South Dakota Army National Guard
Dell Petersen	Environmental Office, Ellsworth AFB
Christopher Corell	NCOIC, EOD Office, Ellsworth AFB

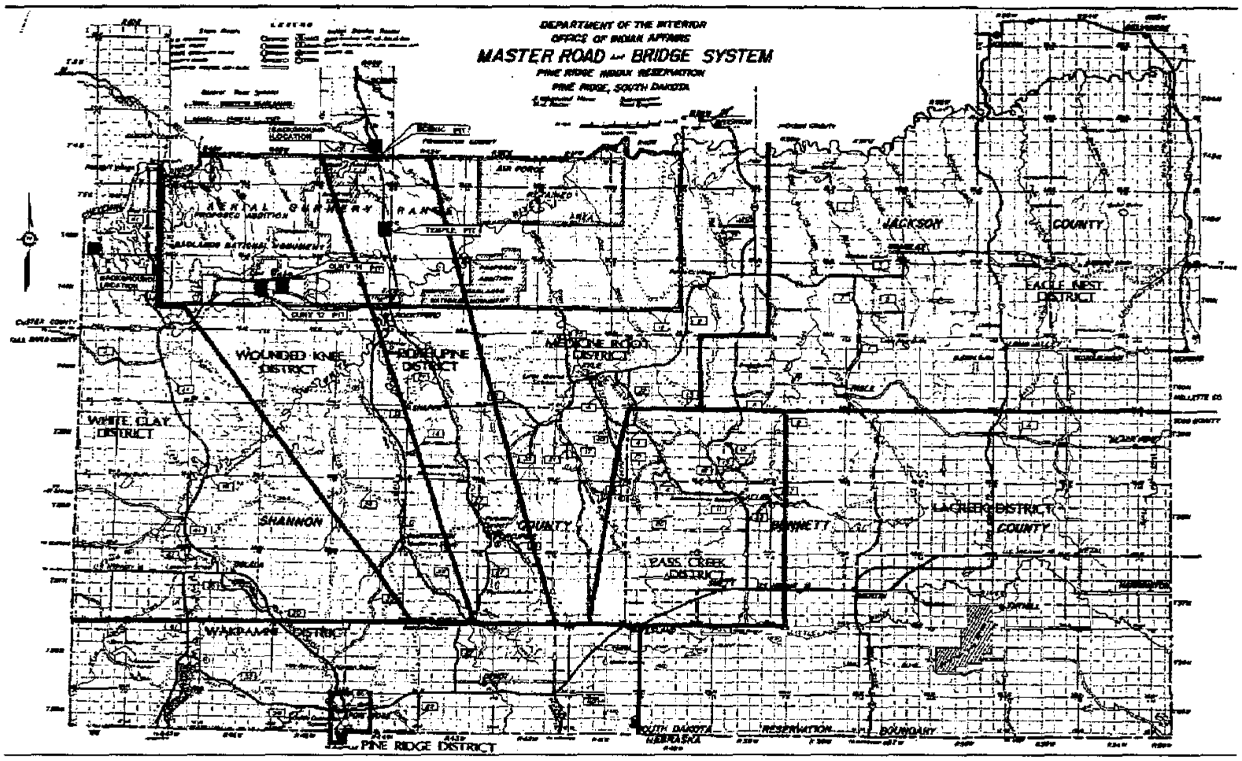


Fig. 1 — Map of the Oglala Sioux Reservation showing the Badlands Bombing Range

The Demonstration Test Plan for this survey was drafted (and approved) based on survey sites within the Air Force Retained Area and the buffer zone surrounding this area. NRL contracted to have first-order survey control points established to support these operations. Because Ellsworth AFB EOD was conducting a survey/clearance of the Retained Area during the same time period as the planned-NRL operation, it was necessary to choose alternate sites for the *MTADS* demonstration surveys. As time was too short to develop a completely new Demonstration Test Plan, we developed a BBR Work Plan, based on unspecified target areas on the Cuny Table. This Work Plan served as an amendment to the original Demonstration Plan and contained the full environmental and Site Health and Environmental Response Plan (SHERP).

The most obvious bombing target on Cuny Table is a circular bull's-eye target referred to as BBR I. The target is clearly visible from the air as well as from the ground. Inspection of the area reveals significant ordnance-related scrap scattered about the surface. The target straddles the fence between leased grazing land on the Badlands National Park and tribal lands currently leased to a farmer and under cultivation. Therefore, access permissions from the tribal president, the Tribal Land Office, and the National Park Service are the only requirements to undertake a demonstration at this site.

In addition, a second bull's-eye target was alleged to be approximately 1 mile to the southeast of BBR I. It was not visible to us from the ground and was not apparent from historical or recent aerial photos. However, OST members of the BBR Project Office assured us that it was located on national park grazing lands (see Section 2.5). This area, then, represented a possible alternative to the target on BBR I or a second survey site. Although an actual bull's-eye was never found, the target was identified based on the clustering of ordnance found during the survey.

Based on these considerations, we chose BBR I and BBR 2 for the demonstration survey. Access to these sites required traveling 1.5 miles of dirt road and 12 miles of gravel road (Hwy BIA 2) after leaving the paved road BIA 27.

2.4 The Primary Survey Target

BBR I is a highly visible circular target composed of a 500-ft-diameter circular earth berm, with a cross-hair berm inside the circle. Figure 2 shows an aerial photograph (1-m resolution) of this target; this photograph was made in the summer of 1991. Figure 3 is a reproduction of a more recent color photograph of the target site. The east-west fence bisects the bull's-eye. The northern side is rented to a local rancher by the National Park Service for grazing. The southern side of the fence is tribal land currently rented as farmland and under cultivation. During the *MTADS* surveys, this area was partially covered by winter wheat (almost ready for harvest) and partially planted in millet, which was about 10 in. tall.

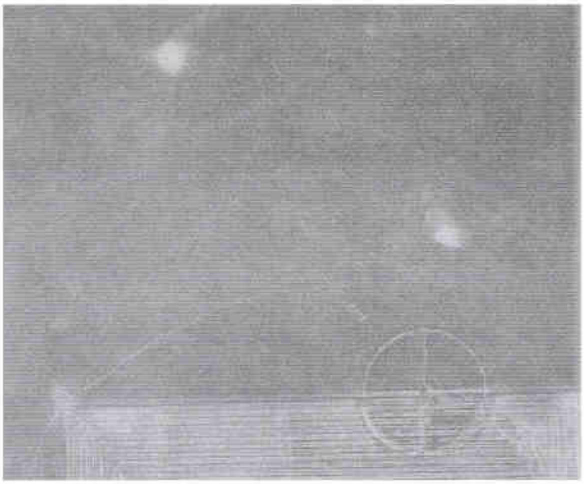


Fig. 2 — Aerial photograph of a portion of Cuny Table that displays the bombing target at BBR I

Fig. 3 — A more recent aerial photograph of BBR I showing the division between cropland and grassland

Figure 4 is a ground-level view of the edge of the berm, which rises about 3 to 5 ft above ground level. This can be traversed by the magnetometer tow platform. Cultivation of the southern side of the target has significantly reduced the height of the berm, however, it is still easily detectable.

2.5 The Secondary Survey Target

OST members from the BBR Project Office claimed that they could point out to us the position of the second target (see Section 2.3). The area they associate with this target is pastureland (in the national park) within the same grazing area as BBR I. Figure 5 shows a 1-m resolution digitized aerial photograph of the approximate area under consideration. The current fences between parkland and tribal land under cultivation are superimposed as white lines. The white X denotes the approximate center of the area pointed out to us by tribal members. There are no detectable surface features similar to those at BBR I. There is, however, a significant amount of ordnance-related scrap scattered on the surface. The scrap is mostly bomb tail fins similar to the surface scrap found on BBR I.

Fig. 4 — Ground-level view of the eastern side of the berm at BBR I

The photographic and map records in the BIA office in Pine Ridge were again searched for information relevant to this target. A poor quality reproduction of a BIA map was obtained that probably dates from the 1950s; it shows the BBR I bull's-eye, which is labeled "bombing target" on this map. There are two additional faint circles. The closest to BBR I is approximately 6,335 ft east and 1,585 ft south of BBR I from caliper measurements on the map. The second faint target is 0.5 mi due east. These circles are labeled "Gunnery Targets" on this BIA map. If the western circle is the target identified by the OST members, it would lie approximately at the circle shown on Figure 5. Rather than being in the parkland, these measurements locate the target on what is currently tribal land. The circle shown on Figure 5 is currently located in a millet field about 200 ft south of and about 200 ft west of the fences shown as white lines on Figure 5. We accepted this general area for consideration as a backup or secondary target for investigation. It is referred to in our study as BBR 2. Figure 6 is a graphic representation of the relative positions of BBR I and BBR 2, the location of the base camp, and the area in which the training data set was taken. These sites were selected as the most appropriate sites to accomplish the survey objectives.

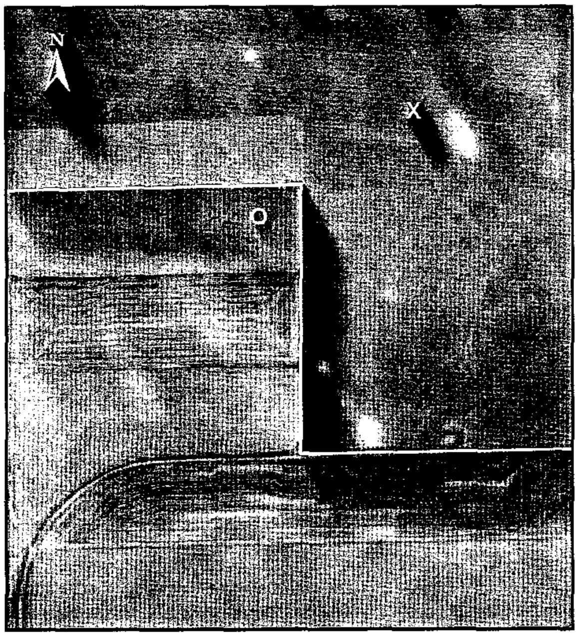


Fig. 5 — Aerial photograph of a portion of Cuny Table proposed to contain a bombing or gunnery target. See text for explanation of the symbols.

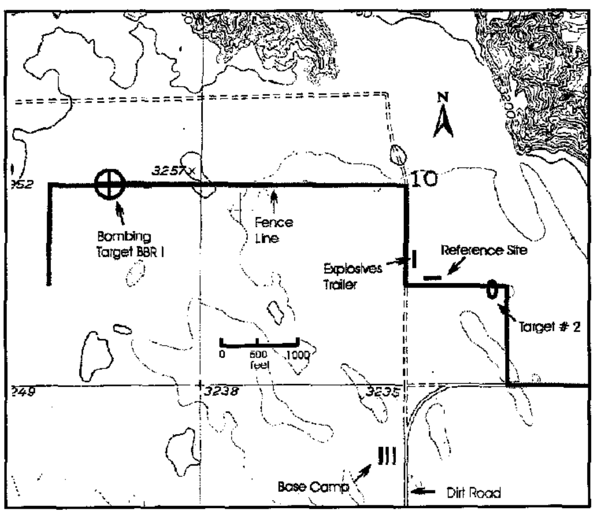


Fig. 6 — *MTADS* survey landmarks superimposed on a 7.5-min map of the BBR on Cuny Table

3.0 THE SURVEY SUPPORT TEAM

3.1 Software and Data Analysis Support

AETC, Inc., is the developer of the current *MTADS* DAS. They were requested to provide field support during this survey. Their primary responsibilities included troubleshooting software or DAS problems and developing required software modifications or utilities arising from the unique situations encountered during the survey. Additionally, they provided support for preprocessing field data files in preparation for target analysis and preparing electronic files for target waypointing using the Trimble Data Collector (TDC). They were responsible for archiving data files and maintaining the log of survey activities. They also provided backup target analysis in case the workload exceeded our planned data analysis capabilities.

3.2 Logistics Support

Nova Research, Inc., provided all required logistic support. They established our base of operations at the remote site. Trailers were rented for a field office and housing computer operations, for a field workshop and storage of *MTADS* and UXO field hardware, and for overnight garaging of the *MTADS* vehicle and sensor platforms. A tent was set up for vehicle and sensor platform maintenance and repairs. An electrical generator and fuel storage were put in place to support the requirements of all three trailers and for overnight charging of the vehicle batteries. Backhoes suitable for UXO operations were leased and put on-site to support UXO crews. Portable toilets were maintained for work crews of 15 people for the 5 weeks of the operation. All rented equipment was promptly removed from the site and the site was cleaned at the end of operations. In addition, Nova was responsible for subcontracting or otherwise hiring local labor as required to support the demonstration. Interface with Native American labor sources was a requisite.

3.3 Work Plans and Coordinating Field Activities

Hughes Associates provided support in researching and developing work plans and schedules and developing health and safety work plans. They were also responsible for coordinating activities of other contractors before and during the demonstration. Additionally, they provided program administrative support and monitored budgets and spending. While on-site during operations, Hughes provided coordination of field and support activities and expertise on ordnance and ordnance-related materials encountered during operations.

3.4 Transportation and Field Support

GeoCenters was responsible for transporting all *MTADS* hardware between Washington, DC, and the field activities. They provided *MTADS* vehicle drivers and mechanical maintenance of all field hardware. The GeoCenters representative served as the site safety officer and was responsible for conducting all daily safety briefings. Additionally, the driver, who is UXO-certified, supervised all field activities of survey support crews and made ordnance and safety-related decisions about situations encountered in the field.

4.0 ORDNANCE REMEDIATION

4.1 CEHNC-OE Participation

An objective of this project was to document the performance of *MTADS* in field activities demonstrating its readiness to conduct UXO site characterizations at DoD ranges and its transition potential as an automated survey support tool appropriate for commercial use by Army Corps of Engineers contractors at ordnance remediation sites. To this end, we contacted CEHNC-OE-CX about their interest in monitoring or supporting our operation at the BBR.

We held meetings with Mr. Charles Heaton, Mr. James Manthey, Dr. John Potter, and Mrs. Mary Dowling at the U.S. Army Engineering and Support Center, Huntsville, AL. They agreed to support our activity through their Centers of Excellence Office (Mr. Jim Manthey) and to provide a three-person EOD field crew (from Army Corps staff) for 4 weeks to conduct target recoveries and evaluations during the remediation process following our waypointing of targets. The EOD field team also had the responsibility for providing explosives and the destruction-in-place of recovered ordnance with potential explosive fillers. Additionally, they provided inert certification of all recovered ordnance scrap for disposal.

4.2 Commercial UXO Support

To augment the remediation efforts of the CEHNC-OE crew, we acquired, by a subcontract through NOVA, the support of Ordrem, a firm providing commercial EOD services. Ordrem's responsibilities included providing a dig crew to prosecute flagged targets. Additionally, they were responsible for waypointing the targets scheduled for remediation by both their and the CEHNC crews. Waypointing is carried out by using the TDC programmed by the target analysts and dig images and dig sheets to precisely locate the specified targets in the field and then by planting a flag with the unique target number at the site. Following the disclosure of each target by the EOD team, Ordrem was responsible for reacquiring the target using the TDC GPS equipment. Ordrem provided four persons to support these efforts for 4 weeks. The waypointing and reacquiring of targets was assisted by Native Americans with HAZWOPR certifications.

5.0 THE WORK PLAN

Subsequent to establishing the primary and secondary survey sites, the drafting of a new project plan was initiated. U.S. Geological Survey topographic maps for the sites were obtained in both hard copy and digitized form. Aerial photographs of these sites were provided by the BBR Project Office, and others were procured through commercial vendors. Using the topographic maps, aerial photos, and data obtained from the initial site visits, we established the location for the base of operations.

5.1 First-Order Control Points

Arrangements were made to have a geodetic survey made of the site to establish multiple first-order control points. Geometrics-GPS was contracted to survey these control points. At the same time, we had a first-order control point shot in near the BBR Project Office for their future use.

5.2 Approvals for Site Access

Before beginning survey and remediation operations, we secured approvals from both the OST and U.S. Park Service. Documentation was provided as to the specific nature of activities to be conducted on-site, including site restoration requisites. Appendix A provides copies of these approvals. In addition to the OST and U.S. Park Service approvals, NRL also coordinated survey schedules with the farmer to ensure minimal interference with farming operations.

5.3 Establishing an Operations Base

It is our experience that the efficiency of survey operations critically depends on having an operating base from which all survey activities are coordinated. For each of the surveys conducted as part of the previous *MTADS* Technology Demonstrations at Twentynine Palms and JPG, NRL has established an on-site office trailer as a base. These facilities serve as a focal point for all aspects of survey operations as well as serving as the location of the *MTADS* DAS. For the effort at the BBR, no facilities of any type were available to support our operation. The nearest source for rental equipment of any type was Rapid City, about 75 miles from the Cuny Table sites.

As remediation activities were to be conducted concurrently with survey operations, we established separate facilities to support the activities. Three cargo containers that had been converted into lighted, air-conditioned office trailers were placed on-site. Figure 7 shows the interior of the trailer used by the survey team. Each metal trailer could be securely locked. The survey and remediation teams were provided separate office facilities (8 by 40-ft trailers). The survey team trailer housed the DAS, communications equipment, and modest office facilities for coordination briefings. The remediation team trailer was used to store field equipment and also to house an electronics repair station and tools and repair supplies. An additional 8 by 48-ft container was used to garage the *MTADS* vehicle and sensor platforms. Power to the trailers was provided by a 65 kW diesel field generator, which was also used to recharge the vehicle, radios, and GPS batteries overnight. Communications

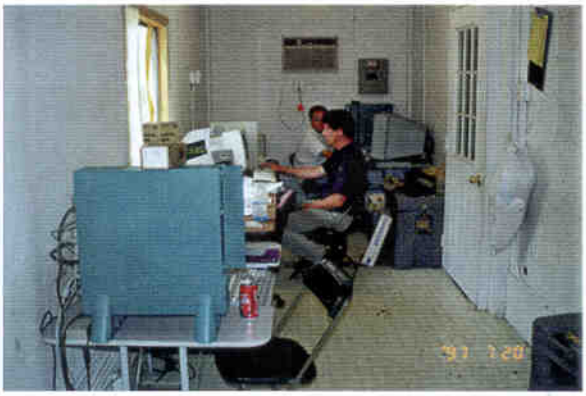


Fig. 7 — Interior of the survey headquarters trailer that supported all data analysis operations

among on-site personnel was provided by handheld VHF radios, with a base station located in the command trailer. Radios were provided to all field and office teams so that constant communications could be maintained. Portable bathroom facilities were installed on-site.

In addition, a 20 by 30-ft tent canopy was located adjacent to the garage trailer, permitting the survey team to service and repair the *MTADS* tow vehicle and sensor platforms out of the sun or rain during the day. A backhoe was leased for the Ordrem remediation crew. An additional backhoe was leased by CEHNC for their personnel. Fuel for the generator and backhoes was provided by a 500-gallon fuel tank located on-site. Although coverage was intermittent en-route to the site, cellular phone communications were available at the site locations.

Figures 8 and 9 show the base camp and most of the equipment put in place to support the demonstration. CEHNC established an explosives magazine trailer about 1 mile north of the base camp inside the parkland fence. This position was about halfway between the base camp and the survey sites.

5.4 Reference Site

By agreement with the sponsor office, we established a small reference survey site. This was set up in a fairly clean area near the explosives magazine (located inside the trailer) as shown in Fig. 6. We conducted magnetometer and pulsed-induction surveys of the site. Three small targets were located in the Reference Site. Each was near surface and appeared to be metal scrap (pieces of bomb fins). These were removed, and small holes were dug using a backhoe to install ordnance items from NRL inert stores that were transported to the site for this purpose. Inert ordnance spanning the range from 20-mm projectiles to 8-in. artillery rounds were used. In addition, the BBR Project Office provided an empty practice bomb casing as an additional reference. After this step, magnetometer and pulsed-induction surveys were

Fig. 8 — Base camp for the survey showing the three support trailers and the power generator

Fig. 9 — Base camp showing the vehicle maintenance tent and the backhoes used for remediation

again conducted. Figures 10 and 11 are image plots from the magnetometer surveys of the Reference Site before and after the inert ordnance was installed. These surveys provided a set of reference signatures that we used in target analysis of the survey data taken on-site. In addition, they provide a background measurement of the geophysical noise level characteristic of this site.

5.5 Survey Site Characteristics

In general, the whole area (i.e., this part of Cuny Table) is geomagnetically clean and allows analysis of very small targets to the noise floor of the rolling sensors. There are some local geophysical magnetic anomalies not seen in the reference site that appear in the BBR I survey. These are discussed in a later section. Because Cuny Table has historically been very sparsely populated, was effectively unpopulated from 1945 to 1965, and has been used only for grazing and cultivation of small graincrops since 1965, the whole area is very free of man-made objects and clutter (except for ordnance clutter). The only man-made (nonordnance) metallic clutter found on-site during these surveys related to fences and fence-building activities.

The geology of this part of Cuny Table consists of a surface layer of black loam, 1.5 to 2.5 ft thick. Below this, at all points where we excavated, is a very coarse off-white-to-gray sand that is relatively homogeneous and extends to a depth of greater than 15 ft. In a few of the deeper holes that we dug, a layer of scattered small rocks

Table 1. First-Order Control Points Established in Support of the *MTADS* Survey

Control Point Name	Latitude	Longitude	Northing	Easting	Benchmark Location
	(NAD 83 (degrees, min., sec))		(UTM, NAD 83 (m))		
OST 1	43, 32, 34.07909	102, 48, 14.13293	4823437.55	677416.96	Cuny Table Sec. 9, Near Center
OST 2	43,32, 34.30368	102, 47, 03.25482	4823486.69	679007.41	Cuny Table Sec 10, Center
OST 3	43, 32, 08.02841	102, 46, 44.02372	482287.59	679460.64	Cuny Table Sec 10, SE Corner
OST 4	43, 31, 16.51732	102, 41, 53.93068	4821275.53	686015.63	Cuny Table Sec 17, SE Corner
OST 5	43, 42, 05.27022	102, 18, 35.51860	4842233.05	716761.31	Bouquet Table NW Corner
OST Base	43, 01, 34.86511	102, 33, 32.28569	4766632.79	698883.67	Roof of BBRP Office

was found dispersed in the sand. Some of these appeared to have a low natural magnetic signature when probed with a handheld fluxgate gradiometer.

Typical temperatures varied between 55° and 95° F when days were sunny and 55° and 75° F during cloudy and rainy periods. Wind velocities were not excessive and typically varied between 0 and 10 mph. The average annual rainfall on Cuny Table is less than 12 in. During the 5 weeks of this operation, we had more than the total equivalent annual rainfall. About half of the time we were working in either rain or very muddy conditions. The extremely wet conditions led to difficult insect (fly and mosquito) problems, particularly during the last 2 weeks of the operation.

6.0 THE SURVEYS

6.1 BBR I North

The Survey Plan selected the northern side of BBR I as the starting point for the survey. This area, located within the national park, is grassland currently grazed by both horses and cattle (Figs. 3 and 4). Except for a couple of low-lying areas, the surface is firm and well drained, allowing surveying during light rain or even after heavy rains. The south side of the bull's-eye was under cultivation in winter wheat and millet. The wheat was within 1 week of harvest when we began operations. We intended to allow the harvest to be complete before entering this area. This was not feasible, however, as intermittent rains delayed the harvest, which was still not complete 5 weeks later when we left the site.

The center of the bull's-eye is the origin of the local coordinate system for this target. In UTM (NAD 83 in meters), the origin of the site is X = 677868.57 E, and Y = 4823457.61 N. Surveying began with the magnetometer array. Five hundred meter-long lines were driven, centered at the bull's-eye. These lines were driven starting parallel to the fence. The fenceline lies nearly (but not quite) east-west. The height of the target berm and the slope of its sides allowed the magnetometer survey to proceed directly across the berm sides.

The tall grass and weeds, the undulating surface, and the 5-ft-high berm sides made it difficult for the driver to maintain his survey track on the one-third mile-long survey lanes. To assist with positional reference during the data acquisition, field support was provided by contracted HAZWOPR-certified field technicians from the local area (Fig. 12). The field support crew was responsible for placing the flags indicating the track position and the end of track. This allowed the driver to concentrate on maneuvering the tow vehicle to maintain heading and to thus avoid creating missed survey areas.

We intended to continue surveying towards the north until targets became sparse or until we were required to begin EM surveying in preparation for the dig teams who were scheduled to begin 1 week after the surveying. Data preprocessing and target analysis began immediately and continued in parallel with the field survey. Field data were usually downloaded every hour and were typically

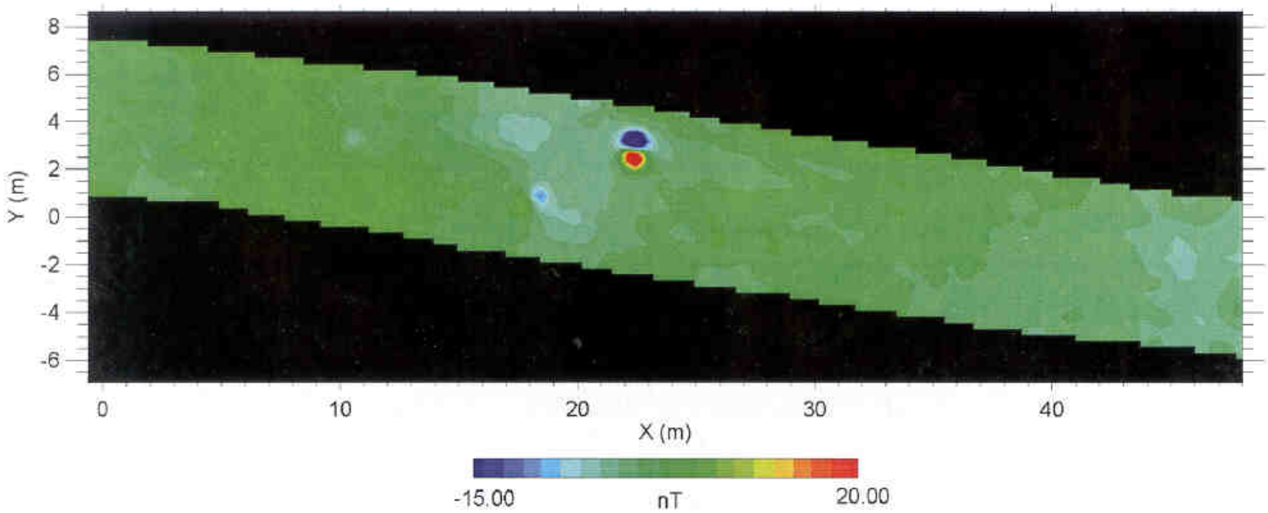


Fig. 10 — Magnetometer survey of the background reference site

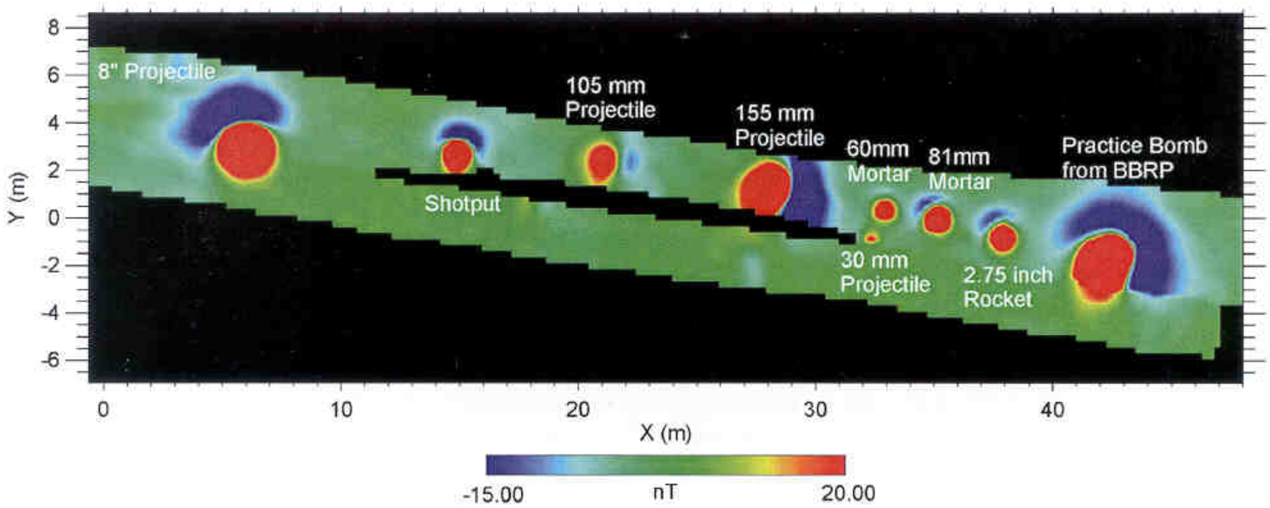


Fig. 11 — Magnetometer survey of the background reference site following installation of inert ordnance

Fig. 12 — *MTADS* field support technicians help maintain the track position during the survey

visualized within 2 hours. When the survey had extended 300 m north of the bull's-eye, targets became more sparse. However, there were still significant large targets at the eastern, western, and northern edges of the survey. Figure 13 shows a magnetic anomaly map for the 300 by 500-m survey conducted north of the bull's-eye. After completing 15 hectares, the magnetometer array was traded for the EM array.

The EM survey began at the center of the bull's-eye, driving the same lanes driven with the magnetometer array. The EM array did not traverse the bull's-eye gracefully, bottoming out at the sensor tray each time the berm was crossed in a perpendicular fashion. After about five round trips, it was observed that several of the fiberglass sensor supports on the tray had failed, rendering the EM array unusable. It took 2 days to procure the necessary repair components and rebuild the sensor support tray. During this period, magnetometry surveying was continued south of the fence in the wheat field. After the array was repaired, EM surveying began again at the northern edge of the area surveyed by the magnetometers. Surveying proceeded southward to about Y = 150 m to define the area to be used for the "training data set." Surveying with the EM array was suspended at the Y = 150-m level to allow target clearance activities to begin north of Y = 150 m. Figure 14 shows the EM anomaly image for the north side of BBR I.

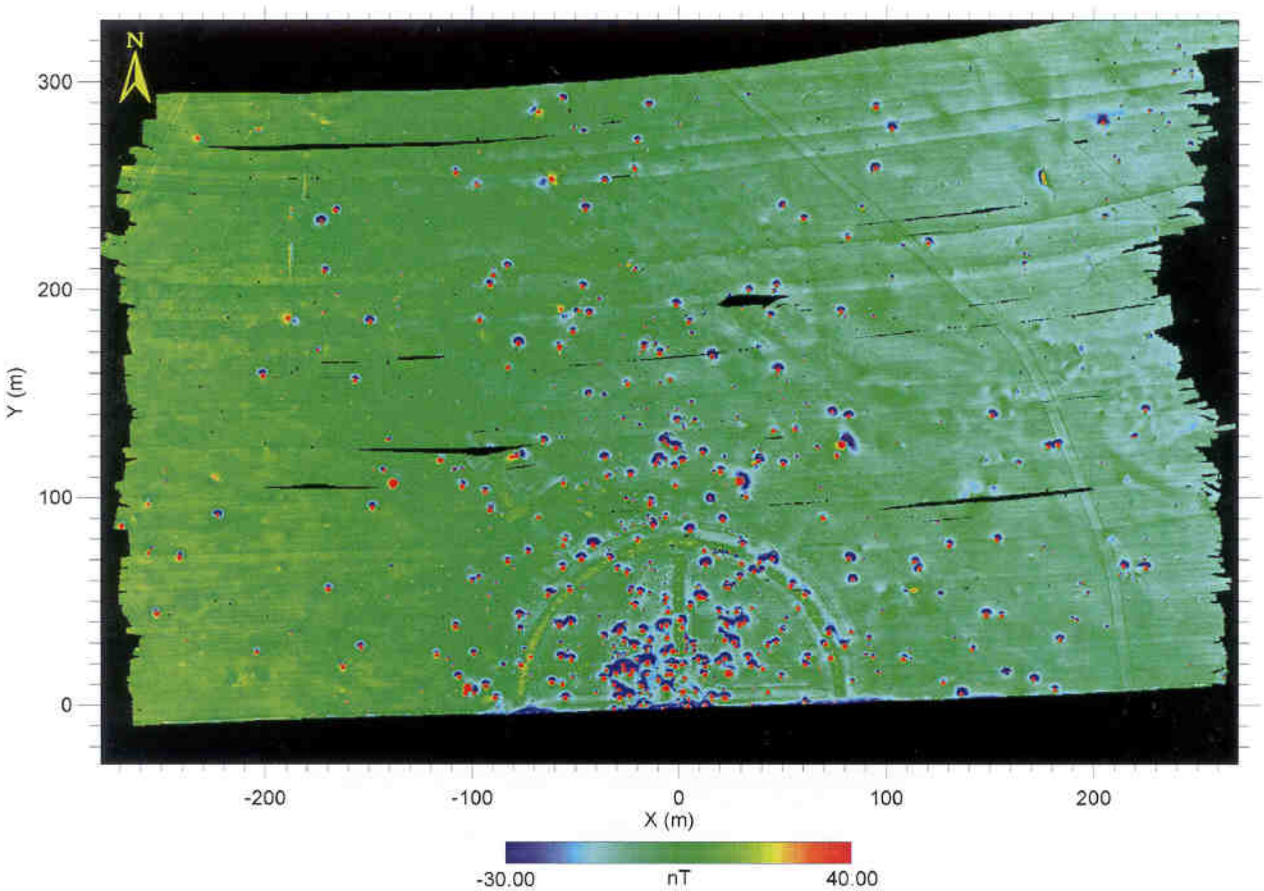


Fig. 13 — Magnetic anomaly image of the north side of the BBR I bull's-eye

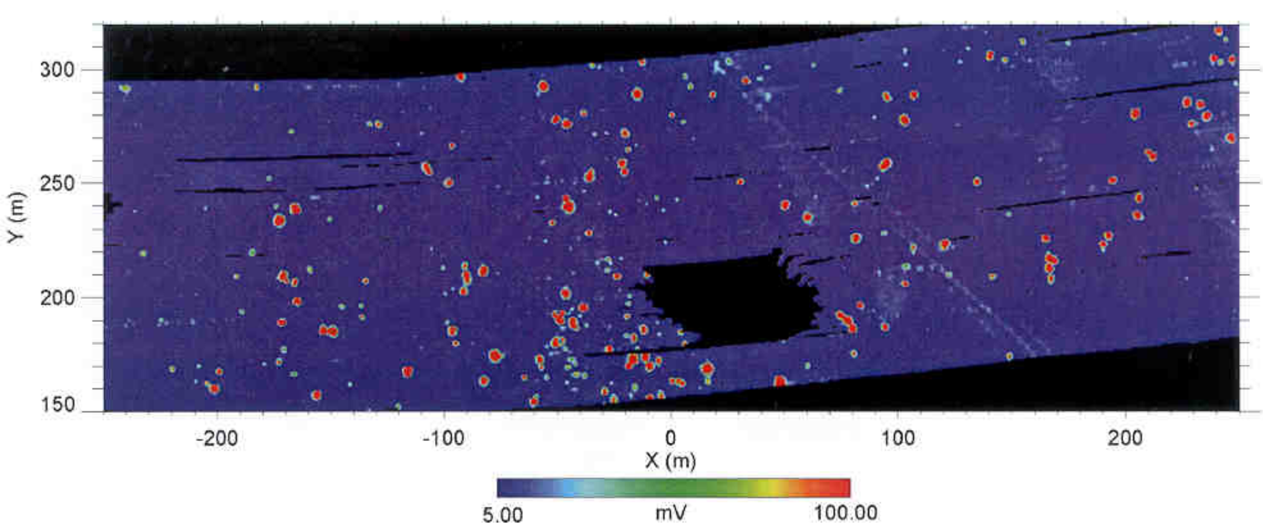


Fig. 14 — Anomaly image created with the EM array for a portion 150 m north of the BBR I bull's-eye

6.2 BBR I South

When the dig teams moved from BBR I to BBR 2, the survey equipment returned to this site to complete surveying south of the fence on the croplands. Working in the croplands was more problematic because of the continuing heavy rains and the deep mud that were much more of a problem on areas not covered with grass. Ultimately, an area of 500 by 300 m was surveyed south of the center of the bull's-eye. About 50% of this area was in mature wheat and 50% was in immature millet. We destroyed about 25% of the wheat crop where we surveyed by mashing it into the ground. The millet stood back up after a day and was not damaged. The farmer was reimbursed for the lost wheat crop. Figure 15 shows the magnetometry survey underway on the south side of the bull's-eye. Following previous tracks in the crops effectively could have been carried out by the driver without assistance. Figure 16 shows the magnetic anomaly image for BBR I South.

Fig. 15 — Surveying the south side of BBR I with the magnetometer array

6.3 BBR 2

Section 2.5 describes the process for choosing the secondary survey site. Surveying on this site began at the time that target waypointing and remediation got underway on BBR I. We began magnetometry surveying of BBR 2 in the grassland. This area, although east of BBR I by more than a mile, is in the same pasture as the north side of BBR I. Because there were no visual clues to locate a target center for this site, we began driving long east-west lines starting about 100 m east of the fence corner shown in Figure 5. The eastern limit of these lines was limited by a low-lying wet area that became a pond further to the north. After about 20 survey

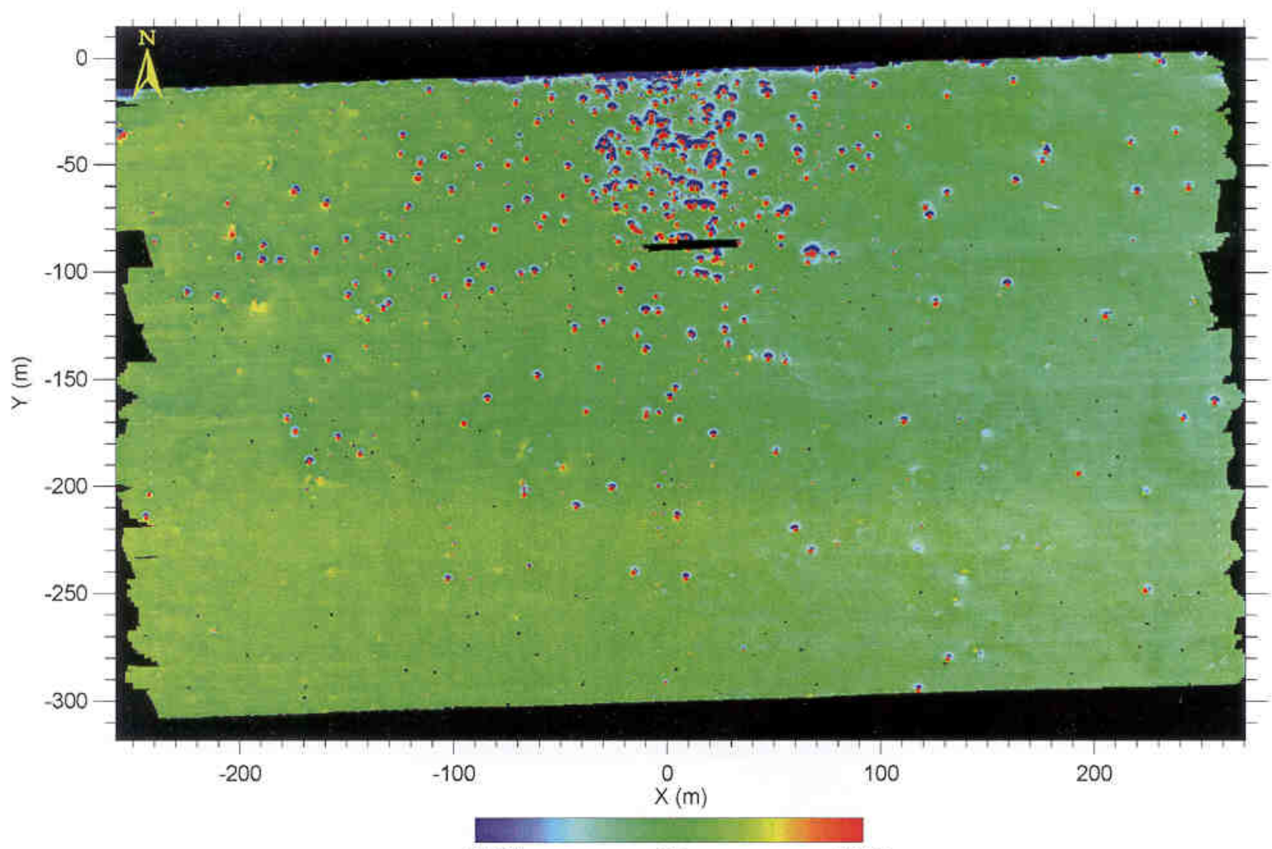


Fig. 16 — Magnetic anomaly image of the south side of the BBR I bull's-eye

lanes were driven, data were preprocessed and visualized. Clustered targets were apparent with a highest density about 30 m to the west of the fence corner. The eastern limit of the survey lanes was extended slightly, and magnetometer surveying was continued toward the north until a block 350 by 200 m was completed. A small area on the northeast corner and a larger area on the eastern edge were missed because of standing water. After completing this area, north-south survey lines, again in the pasture land, were driven to form a survey block extending almost 400 m north to south and 350 m east to west.

At a later time during a period of dry weather, the magnetometer array was moved onto the tribal land to survey a small block (about 80 by 130 m, or about 1 hectare) in the millet field to complete the survey of the area that we suspected would contain the target center. Figure 17 shows a magnetic anomaly image of this complete survey. The ill-defined center of the target cluster lies about 25 m south and east of the fence corner.

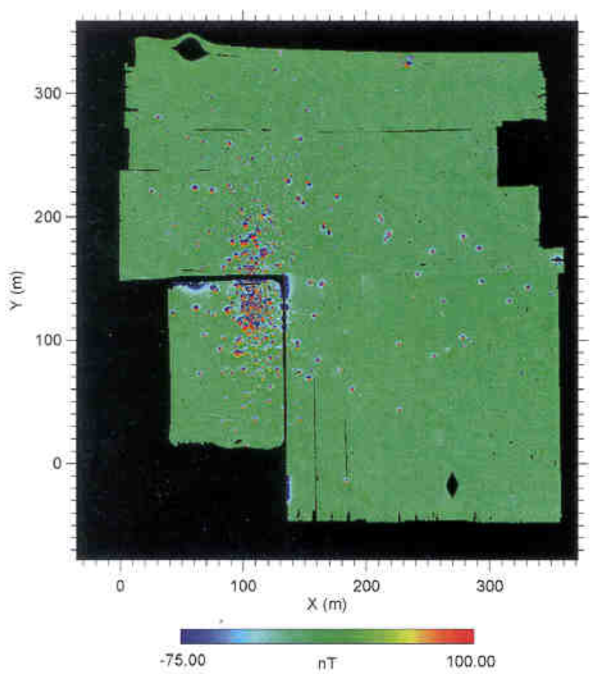


Fig. 17 — Magnetic anomaly image of BBR 2

The EM array was used to survey the area within the parkland that had been surveyed using the magnetometers. Figure 18 shows the EM anomaly image resulting from this survey. To avoid further damage to the millet, the EM array was not taken into the cultivated area. The target density near the center of the cluster is so high that effective single target analysis cannot be carried out. The variety of target signatures within the millet field is very similar to those in the parkland.

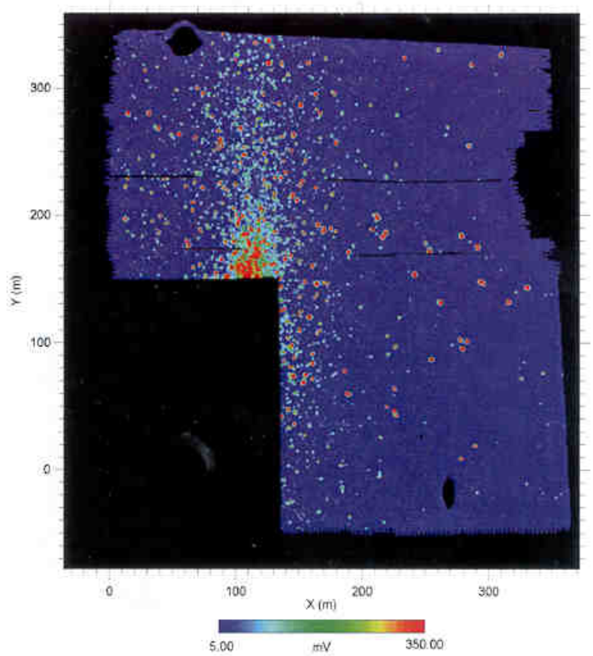


Fig. 18 — EM anomaly image of BBR 2

7.0 TARGET ANALYSIS

7.1 The Training Data Set

The survey plan called for selecting a survey area containing 50 or more targets in a mix of target sizes and digging all targets in the set. The results of this remediation would presumably provide information about the types of ordnance (and nonordnance) present at the site. Prosecuting the smaller targets would determine whether small ordnance (such as 20 mm projectiles) were present. The measurements at the Reference Site demonstrated that these items should be detectable at this site, particularly with the EM array.

Analysis of the magnetometry data from the north side of BBR I resulted in selecting 485 targets. About 30% of these targets, based on calculated size and depth, were likely candidates to be buried bombs. Because of the difficulties in traversing the berm with the EM array and the need to complete both magnetometer and EM analyses of the data for the training data set, once the EM platform was repaired, we began surveying the area chosen for the training data set.

The magnetometry survey area north of Y = 150 m in local coordinates had 82 analyzed targets. This area was selected for the training data set. EM surveying at this site was stopped when it reached this point and all EM targets were analyzed. The EM analysis was carried out working jointly with the magnetometry target analysis screens using the techniques developed analyzing the Twentynine Palms and the JPG III data. This joint analysis added seven new targets to the dig list that did not appear on the magnetometry target list. This resulted in a combined list of 89 targets. Forty-five to fifty-five of these targets were likely bomb candidates.

In the Twentynine Palms and JPG data analyses, we used the EM target analyses to exclude certain magnetometer target picks based on improbable EM signatures. This worked very well, particularly at JPG, in declaring numerous magnetometer signals as false alarms because the EM signatures were too small to be ordnance. In the BBR training data set, we did not exclude any analyzed magnetic targets because digging them up could potentially provide information valuable in devising future discrimination algorithms.

Therefore, 89 targets were dug in the training data set. This resulted in the recovery of 40, M 38 practice bombs; 4 rocket bodies (2.25-in. SCAR) or rocket warheads (2.75-in.); 33 pieces of ordnance scrap (mostly tail fins); and 12 dry holes (false alarms). On all of BBR I, we remediated a total of 146 targets. Therefore, this report discusses in detail the remediation results for BBR I based on all the targets that were dug on the site rather than limiting observations to the training data set.

For logistic reasons, much of the digging took place on BBR 2. This was necessary because, for safety, we had to maintain both a minimum separation between each of the dig teams and a minimum separation of the dig teams from the survey team members. We attempted to remediate in areas that had both EM and magnetometry data analyzed. Also to minimize crop destruction, we chose to not use the EM array to survey any of the croplands. While the dig teams were prosecuting the BBR I training data set targets, the magnetometer and EM surveys and data analysis got well ahead on BBR 2. Therefore, the dig teams concentrated much of their efforts on the second site. The choice of BBR 2 was also influenced by the greater variety of targets on the second site.

7.2 BBR I Target Analysis

A complete target analysis was carried out using the magnetometry data for both the north and south side surveys. EM surveys were carried out only on the north side of the bull's-eye and were concentrated on the area north of Y = 150 m (in local coordinates) because this was the area used for the training set data. The complete printout of target analysis tables (Tables 5 through 11) is presented in Appendix B. In the BBR I North magnetometer survey, 485 anomalies were analyzed and reported as targets as detailed in Table 5. The EM survey of (~50% of this area) BBR I North was analyzed with the (previously analyzed) magnetic anomaly analysis window side by side with the EM analysis window. A total of 171 EM targets were picked; 51 of these did not have counterparts in the magnetometry analysis. The EM target analysis is provided in Table 6. On the south side of the fence in BBR I South, 219 targets were picked from the magnetometry survey (Table 7). The number and density of larger targets are similar on the north and south sides of the bull's-eye. The total number of small shallow targets is lower on the south side probably because the area has continuously been under cultivation by the current farmer since control was returned to the OST. The farmer told us that he has picked up metallic scrap from the surface and either sold it or pitched it into the fence rows. Additionally, it is likely that some of the smaller surface items have become more deeply buried (and undetectable) as a result of cultivation.

Figure 19 shows that the analyzed target sizes fall into a bimodal size distribution. The smaller targets tend toward an analyzed size of 40 ± 20 mm while the larger size grouping analyzes as 160 ± 50 mm. Figure 20 shows a similar bimodal distribution in analyzed target depths. The smaller targets lie between 0 and about 25 cm while the larger targets tend to be buried between 35 cm and 1.2 m.

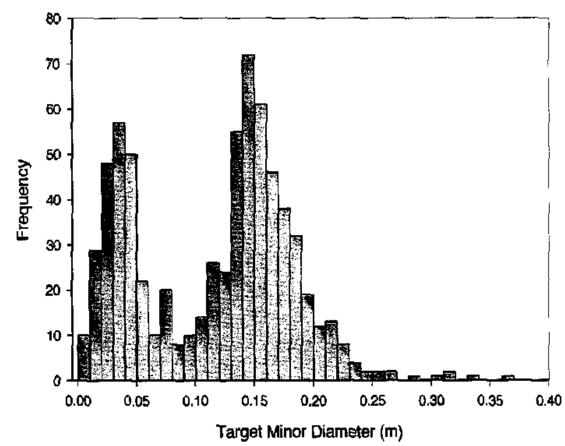


Fig. 19 — Analyzed target size distribution for all targets on BBR I

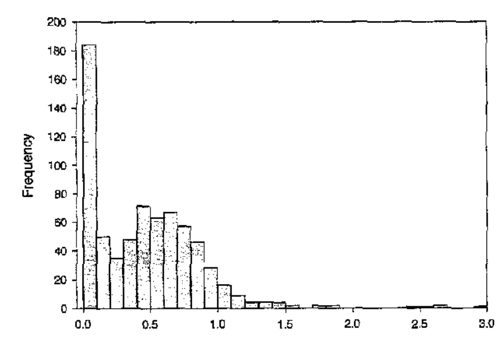


Fig. 20 — Analyzed target depth distribution for all targets on BBR I

7.3 BBR 2 Target Analysis

The perimeters of the magnetometer survey on BBR 2 were extended several times. Following completion of the magnetometer survey, all data files were again assembled and the local coordinate system was redefined to contain all the data. The UTM (NAD 83) position of the origin of the local coordinate system is 679323.73E and 4822924.25N in meters. Including the area in the millet field, the magnetometry data analysis resulted in 647 target picks. Table 10 gives the target analysis results.

The EM target analysis was carried out while simultaneously viewing the magnetometry analysis window and target picks. A total of 239 EM targets were analyzed, including 60 targets that were not part of the magnetometry target list. Table 11 presents the complete EM target list. During the survey operations, it was noted that a significant amount of the OEW surface clutter was aluminum, much of it either tail fins or scrap from the bodies of 2.75-in. rockets. For this reason, the EM analysis particularly concentrated on signatures that were weaker or absent from the magnetometry data to emphasize the different detection capabilities of the two arrays. Because this rocket has a ferrous warhead 2.75 in. (70 mm) in diameter, an effort was made to pick targets of this size for remediation.

Figure 21 shows the target size distribution and Figure 22 shows the target depth distribution. The strong bimodal size distribution that was seen in targets in BBR I is not as apparent on this site. This is primarily influenced by the lower incidence of the 150-mm targets on this site relative to the smaller targets. The distribution of target depths on BBR 2 is similar to the bimodal distribution seen on BBR I. A primary difference between the two sites is the much higher incidence of small, shallow, OEW clutter targets on this site.

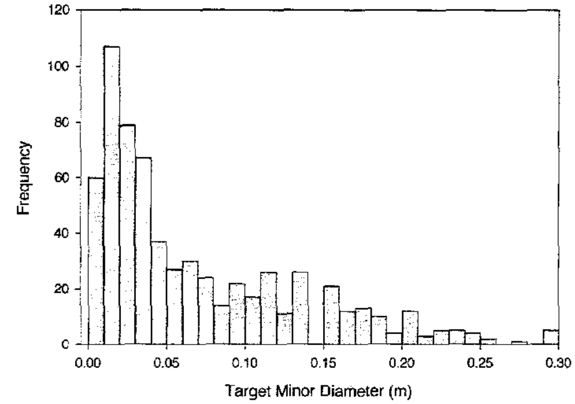


Fig. 21 — Analyzed target size distribution for all anomalies on BBR 2

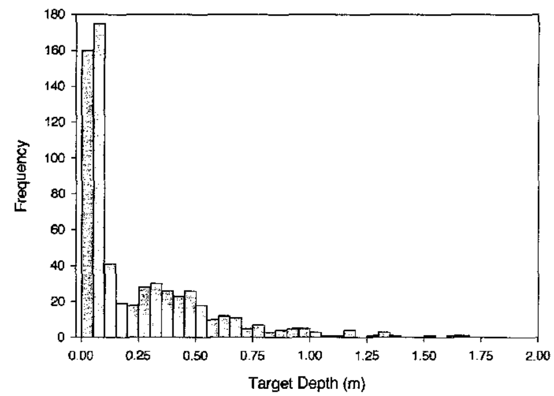


Fig. 22 — Analyzed target depth distribution for all anomalies on BBR 2

8.0 TARGET REMEDIATION

The remediation teams began work 1 week after the beginning of survey operations. Before they could begin digging targets, surveying and data analysis had to be completed for both the magnetometer and EM arrays. During the first week of surveying, it was decided for reasons discussed above that the initial digs that comprised the training data set would consist of all analyzed targets on BBR I on the north side at Y >150 m. The targets in this area were somewhat less dense than nearer the bull's-eye, making it less likely that prosecuting an individual target would disturb an adjacent target. The distribution of target sizes and depths appeared representative of the remainder of the site. Finally, the 500-m length of the plot meant that, by paying attention, both dig teams could work on the site at the same time while maintaining the required separation from each other.

8.1 Dig Lists

The target list for digging initially included all targets for Y > 150 m on BBR I. After completing this training data set, we continued to assemble target lists while on this site that maintained a distribution of target sizes and depths similar to those in the initial group. Based on a variety of considerations, we set up the dig lists to encompass 50 by 125-m areas. This meant that there were eight dig lists for the training data set. Cows tended to pull up flags (to see what they tasted like?) so we tried to waypoint no more than the next day's targets for remediation. On the upper half of BBR I North, the 50 by 125-m area contained about the number of targets that a single dig team could prosecute in a day. The *MTADS* DAS target files were downloaded as tab-delimited ".txt" files and were imported into spreadsheets on a PC. Once the site was broken up into these plot areas, the spreadsheets were sorted by area to create dig lists. These lists were provided to the waypointing crew (as an electronic file on the TDC) and to the dig crews as a hard copy.

8.2 Dig Images

The *MTADS* Data Analysis window size was adjusted to 50 by 125 m size, the target analysis polygons unique target identification numbers were superimposed, and postscript images were created and printed using the color printer. These were used by the waypointing and digging teams. Adjustments were made in the output formatting of the target boxing and the target font point size so that the individual targets were readable from the images in the field. Figure 23 is an example of a dig image from the training data set region These images served several purposes. To minimize the time spent walking between targets, the waypointing team would start at one edge of the image and generally proceed across the area. The image allowed the team to quickly identify the nearest target by number and locate it in the TDC computer. The dig image allowed the dig team to visually identify the target signature, see nearby clutter that needed to be accounted for, and be aware of other nearby targets so that they would not be accidentally disturbed.

8.3 Preparing Dig Sheets and Programming the TDC

It quickly became apparent that numerically keying in the coordinates of all the targets to be waypointed into the TDC was not only very time consuming but was likely going to lead to transcribing errors. A software utility was written on-site to interface the spreadsheet containing the target information for downloading into the TDC. This was ultimately supplanted by software directly purchased from Trimble. Once the data file was prepared in the correct format, it was downloaded into the TDC by serial-port hardwire connection.

A sample dig sheet was prepared as part of the work plan to prepare for this operation. Its design was intended to assist the dig teams by providing target location, depth, and orientation information. Its comment line also contained information from the target analyst alerting the dig teams to some unique feature of the target or to the presence of nearby clutter or other targets. The dig sheet also contained spaces to be filled-out by the dig teams based on their observations and a box in which to insert a sketch of the target. Figure 24 shows an example of a filled out dig sheet from this site with a copy of the photograph of the target taken at the time of its recovery.

8.4 Waypointing Targets

The waypointing and dig teams insisted that it would be difficult for them to maintain their orientation without using large flags gridding the site. This is probably a holdover "security blanket" based on the fact that all of them were "mag and flaggers" who had no significant prior experience with GPS. They were used to gridding sites and walking grid lines to do hand surveys. As a compromise, we programmed the 50 by 125-m corner positions for the area of the training data set into the TDC

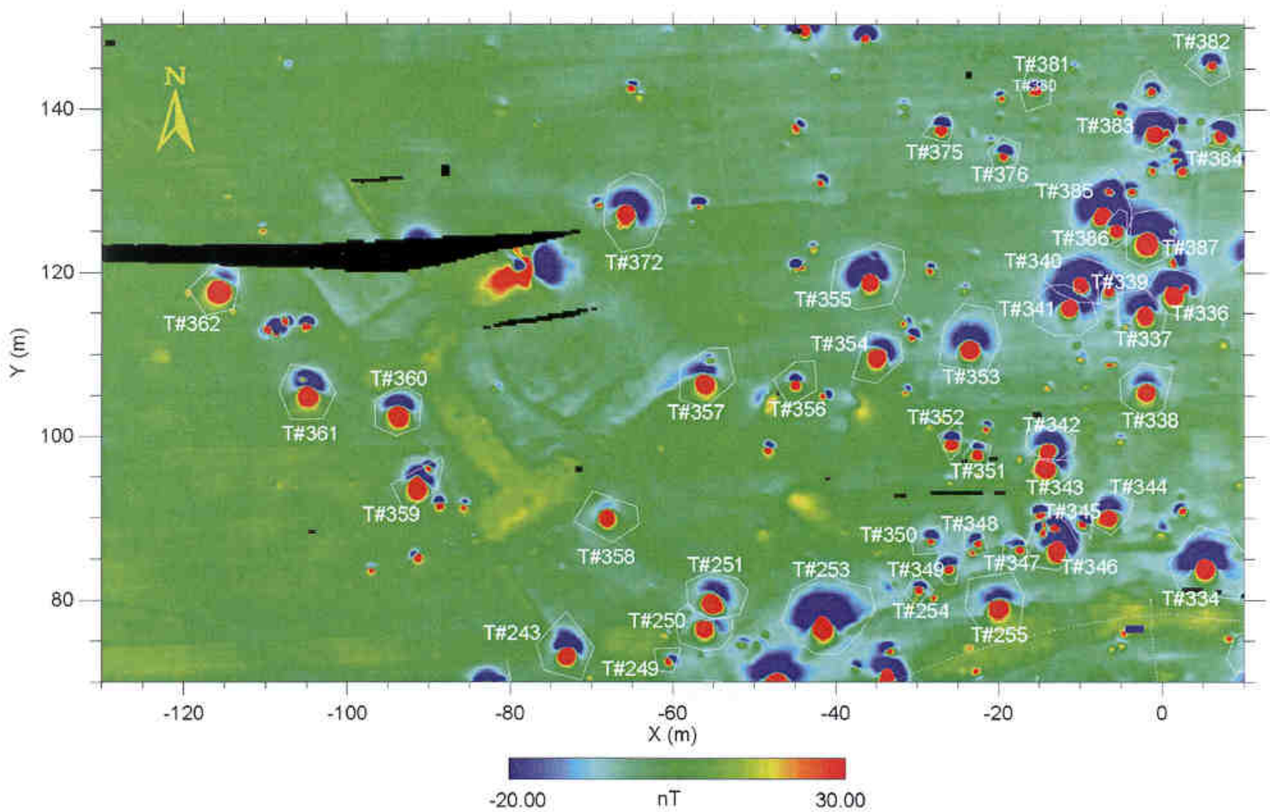
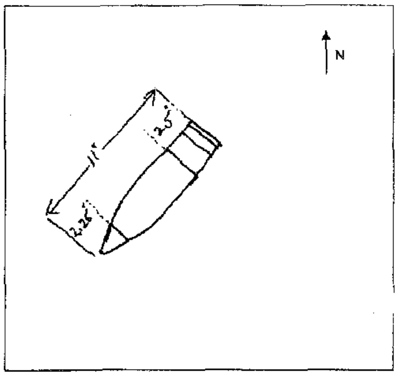


Fig. 23 — Magnetic anomaly image prepared as a dig image for the waypointing and remediation teams to use in the field

Badlands Bombing Range | **DIG SHEET** | *MTADS*

	Target Num.	Lat_{cm}	Lon_{cm}	Dia. (in)	$Depth_{cm}$ (ft)	$Depth_{nose}$	$Depth_{base}$	Azimuth
Predicted	BR3-466	43.539002277	-102.778366642	2.4	0.8	[redacted]		206T
Actual	[redacted]	43°32.340176	102°46.702030	2.75	9.5	10"	9"	205 M
Comment	Remnant Magnetization							

Field Drawing



Field Comment: Intact and still round w/ Blue Paint and markings

Field ID: 2.75" Practice Warhead MK1 Mod

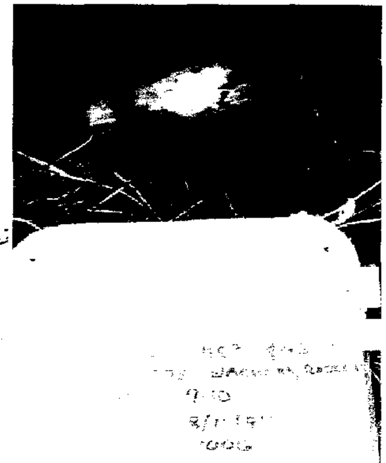
☐ Fuzed ☑ Unfuzed

☐ Live ☑ Inert

☑ Ordnance ☐ Ordnance Related ☐ Non-ordnance

Estimated Weight: ____________

Photograph Number: 7-10



Site: BBR-3 Date: 8-11-97 Time: 1006 UXO Supervisor: THRIFT

Fig. 24 — Example of a dig sheet and target photograph prepared by the dig team

for the waypoint team to flag and additionally set up flags at the site corners.

Both Ordrem and CEHNC dig team members were provided orientation sessions with the TDC controller and were given a waypoint list containing the practice ordnance coordinates at the Reference Site with which to practice. The TDC readout directs the operator to each target by providing a continually updating vector and distance to the selected target. After orientation and some initial work building confidence in the system, Ordrem assumed responsibility for waypointing targets. They worked with support from the local labor team to waypoint and flag the targets.

The waypointing team was also responsible for reacquiring target positions after they were uncovered by the dig team. The dig team's responsibility was to uncover the target and certify it as safe for the waypointing team to reacquire. The waypointing team reacquired each target by placing the point of the staff at the approximate center of the target. The GPS position was recorded by the TDC and read to the dig team to also record on the dig sheet. The TDC, using both the original target position and the reacquired position, computed the difference and the vector between the two positions and saved this information. The waypointing team was responsible for downloading these files back to the PC to become part of the permanent target record.

8.5 Prosecuting Targets

The general instructions provided to the dig teams were to prosecute the surface and very shallow targets from each dig list before excavating deeper targets. The intent was to dispose of these targets before carrying heavy equipment on-site or moving significant quantities of dirt that might disturb nearby surface targets. This approach was generally followed, although equipment sometimes disturbed targets from an adjacent dig area before working on that site. This did not happen very often.

UXO dig teams operate under stringent safety requirements imposed by their charters. Safety standards and technical guidance dictate all field operations. OSHA safety requirements must also be followed during hand and mechanical excavation operations. UXO teams establish exclusion zones around investigations, operate under a buddy system and follow OSHA's trenching requirements during investigation of deeper targets. Non-UXO personnel are not allowed into a team's exclusion zone during intrusive operations, and each UXO team must be separated from the other by an established safe distance. UXO teams maintained on-site radios for communication with all other *MTADS* personnel.

Dig teams followed the following procedure when prosecuting targets:

1. Working from the dig image and the dig list, the dig team member locates the waypoint flag with the unique target number corresponding to the target.
2. The target is investigated using either mechanical or hand digging techniques. Surface and shallow targets are revealed using hand tools.
3. If a target is ordnance, positive identification of the fuze and filler is made prior to any movement of the item.

4. Once an item is determined to be safe, it is reacquired by the waypointing team without disturbing its position.
5. Following reacquisition, the target is photographed and the dig sheet is completed.
6. The target is then removed for disposal or flagged to be blown in place by the CEHNC team.
7. The final remediation step is returning the removed soil, tamping the soil, and returning the site to grade.

Figures 25 and 26 show shallow and deep targets being prosecuted. There were relatively few very deep targets. Targets such as the 250-lb bomb shown in Figure 25 require up to 3 hours to fully complete. The shallower targets may require only a few minutes. Overall, each dig team completed an average of 20 targets per day.

Fig. 25 — A UXO specialist prosecuting a 250-lb bomb at 2.5 m

Fig. 26 — UXO specialists prosecuting a shallow target

8.6 Remediation Results

8.6.1 BBR I Targets

Originally, remediation on BBR I was divided between the training data set and the remainder of the BBR I North survey. Because there were 89 targets remediated north of Y = 150 m and a total of 146 targets on the whole site, all targets on BBR I North are addressed together. Table 10 summarizes the results for the targets remediated on this site. The ordnance remediated from BBR I includes four sand-filled M 58 GP bombs (250 lb), 70 sand-filled M 38 practice bombs (100 lb), three SCAR 2.25-in. practice rockets, and one warhead from a 2.75-in. rocket. None of these items was high-explosive filled. However, each of the practice bombs was dropped with a 2-lb black powder spotting charge. In an M 38, this is contained in a can at the tail. In some cases, this charge failed to detonate on impact, requiring the ordnance to be blown up in place. On the north side of BBR I North, 51 items of OEW scrap were recovered. The majority of these items were tail fins or parts of tail fins from the bombs and 2.25-in. rockets.

The M 38 practice bombs are composed of thin-walled sheet metal. Very few were remediated in anything close to their original conditions. On impact, they tended to crumple in accordion fashion, creating objects both shorter and larger in diameter; many were almost spherical. Figure 27 shows an M 38, which is in relatively good condition; even the tail fins are intact. The widely varying conditions of these items are responsible for the wide distribution of predicted M 38 ordnance sizes (peaked at 150 mm), as shown in Figure 19.

The OEW scrap targets varied in size up to about 25 cm. The dipole fits to many of these targets make them indistinguishable from similar-sized real ordnance items. The position and depth predictions for the OEW items tended to be very good. If a scrap target had a distinct longer dimension, the dipole fit tended to correctly predict the longest dimension as the azimuth of the target.

Fig. 27 — An M 38 practice bomb recovered at BBR I

None of the ordnance items remediated at this site (or at BBR 2) indicated that any live ordnance had been used against these targets. We did not recover small projectiles typical of aerial practice gunnery and the 2.25-in. SCAR rockets were manufactured only as inert practice items. We remediated all targets on BBR I that had predicted sizes consistent with ordnance larger than M 38s. We therefore believe that it is highly probable that the only danger at this site from UXO is from M 38 ordnance that still have intact spotting charges. About 10% of the M 38s that we dug had failed to detonate their spotting charges on impact. About half of the M 38s with undetonated spotting charges had the spotting charge canisters ripped or fractured such that the black powder had been exposed to the elements for many years.

There remain between 125 and 150 unremediated M 38 targets within 500 m of the BBR I bull's-eye. Based on our observations as described above, there are likely 12 to 15 of these with undetonated spotting charges with perhaps half of the 12 to 15 that still have significant potential, if disturbed, to detonate the spotting charges. Table 10 presents the coordinates of all of the remediated and unremediated targets. If one wished to completely remediate this site, our observations indicate that the only targets that pose a threat are the M 38s. These items have predicted ordnance diameters between about 130 and 230 mm. No targets were remediated on BBR I South.

8.6.2 BBR I Resurvey

A section of BBR I within the training data set area was resurveyed with the magnetometer array. In part, this was done as a quality assurance/quality control check on the *MTADS* survey and the remediation process. An additional reason for the choice of this area is that it contained several targets that were dug and declared to be geophysical anomalies. This latter issue is discussed in the Section 8.6.3.

Figure 28 shows magnetic anomaly images of a portion of the resurveyed area before and after remediation. The remediation very effectively removed the ordnance targets from the site. In a few cases (Targets 418, 426, and 441), the boxed targets included both large objects and smaller scrap items. Only the large targets were designated for remediation on the dig sheets and these were prosecuted. In other cases (Targets 419, 429, and 434), when the M 38 targets were removed, small pieces of scrap (probably tail fins) were left behind and appear as small targets in the resurvey image. Target 471 does not appear in the dig sheets: it was apparently overlooked during waypointing or the flag was removed. It was not remediated.

Target 373 is a more interesting case. It originally had poor fit parameters but was identified as a shallow M 38. When remediated, an M 38 was found within 1 cm of the predicted depth and 3 cm of the predicted position. Reanalysis of Target 373 following the resurvey provides a high-quality fit (0.978) and predicts an M 38-sized target 75 cm deeper than the original analysis. It is apparent that the original Target 373 comprised two M 38s, with one almost on top of the other. The deeper target was left in the ground when the shallow one was remediated. Normally, EOD teams scan the bottom of the hole with a metal detector before it is refilled. The last two targets, Targets 424 and 433, are discussed in the next section.

8.6.3 BBR I Dry Holes

Thirteen targets dug on BBR I were reported as dry holes. Most of these targets lie in the area of the training data set where all targets were dug. Targets 424 and 433 in Figure 28 are examples. These targets are associated with geological or geophysical phenomena rather than man-made ferrous objects. They fit a ferrous dipole model less well than ordnance or OEW targets. Additionally, they have a physical appearance that is very different from ferrous targets at this site. They visually appear more extended, the edges appear much less crisp, and the dipoles are oriented in a random fashion. On this site, after the first two of these dry holes (and a few M 38s) were dug, it was possible to differentiate with assurance between these two target types. The remainder were dug from curiosity and because they appeared in the training data set.

Figure 29 shows two additional targets of this type with anomaly images before and after they were dug. Targets 460 and 461 were predicted to be 3.5 and 2.5 m deep. In all four of these cases (Targets 424, 433, 460, and 461), holes were dug slightly deeper than the predicted target depths. All were declared as dry holes. In some cases, using handheld sensors, there were indications of slightly magnetic gravel or clay, but in no cases were hard targets detectable with handheld sensors, even at the bottom of the holes. In all cases, after the holes were refilled, the signatures remained, although somewhat perturbed in some instances.

One final attempt to understand this phenomenon was made. Target 469 is another example of this type of anomaly. The low-quality dipole fit predicted a target at 3 m. In this case, before remediating, a series of boreholes were dug as shown in Figure 30. A handheld cesium vapor sensor was lowered into each hole, taking readings every 6 in. Following this, the larger backhoe was used to excavate the target to a depth of 16 ft. A very large hole was created and all the excavated soil was mixed and replaced in the hole and returned to grade. Figure 30 shows that, in this case, the geophysical anomaly giving rise to Target 469 has been effectively destroyed. The borehole information is still being evaluated. We intend to publish a paper on this phenomenon based on this experimental information. We conclude for now that the magnetic anomalies that were dug on

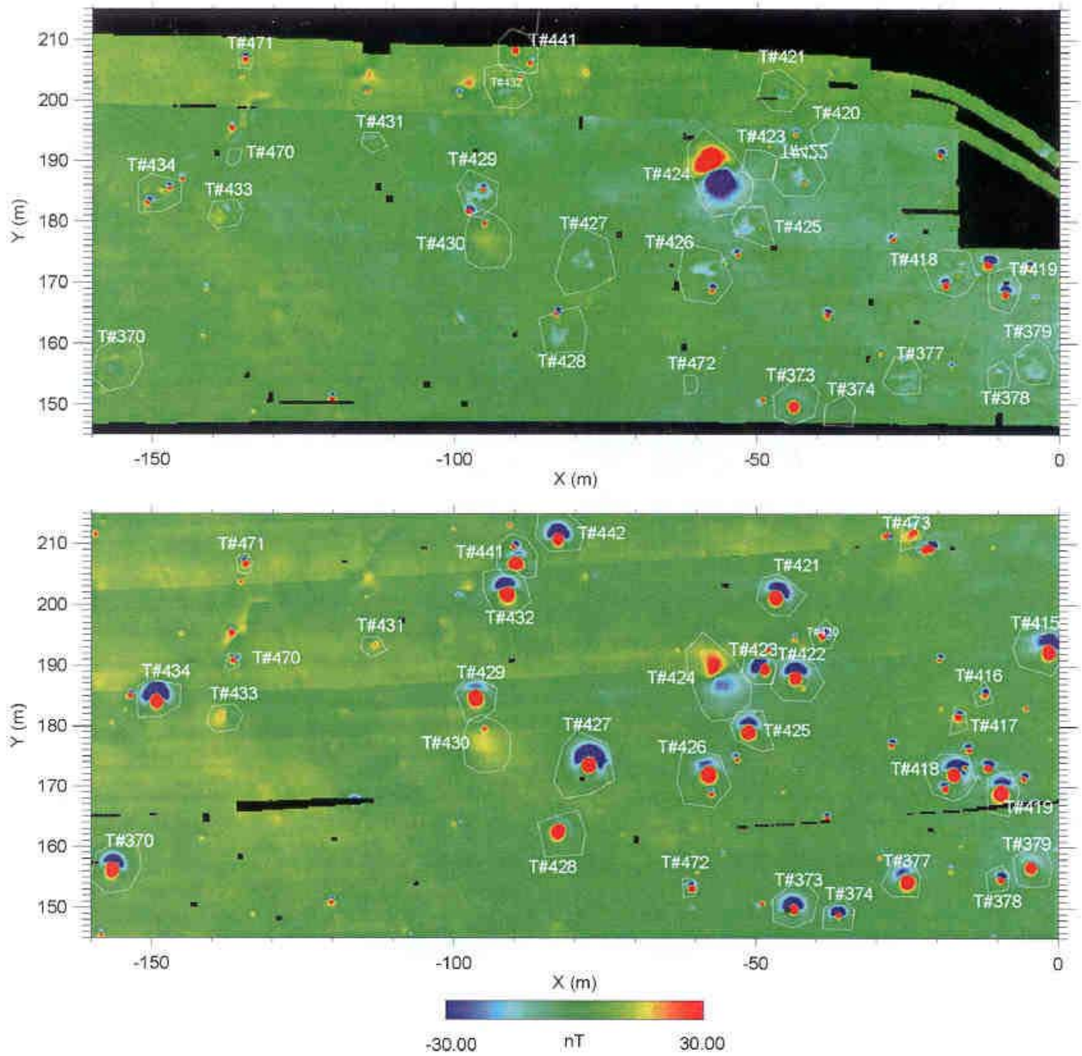


Fig. 28 — Magnetic anomaly image maps of a portion of BBR I before (lower panel) and after (upper panel) target remediation

this site and declared as dry holes have a geological/geophysical origin and that our point dipole analysis of their signatures underestimated their depths.

8.6.4 BBR 2 Targets

A total of 255 targets were dug by the two ordnance remediation teams on BBR 2. Although there is currently no discernible bull's-eye at this site, the center of the area that must have been the original target is heavily saturated with both large targets (mostly M 38 practice bombs) and rocket bodies as well as copious OEW scrap. The whole 350 by 380-m surveyed area has a general scattering of M 38 practice bombs. More probably lie outside the survey area. Although this area was used as a bombing target, it was much more heavily used as an aerial gunnery target for 2.25-in. SCAR and 2.75-in. rockets. The full range of analyzed target sizes was sampled in our remediation, however, we concentrated on smaller targets with the intention of sampling smaller ordnance.

M 38s were the only bombs found at this range; 17 were recovered. Twenty-eight SCAR rocket bodies were recovered. Some were intact, but most were bent, crumpled, or showed evidence of low-order detonations, presumably from residual propellant that was burning at impact. The 2.75-in. rockets have aluminum bodies, venturies, and tail fins, so only the steel warheads were recovered intact. Eleven intact 2.75-in. rocket warheads were recovered. This many more were recovered as scrap, resulting most likely from low-order detonations from residual propellant. There were only a very few scraps recovered that might have been involved in high-order detonations.

One hundred and sixty-eight pieces of ordnance-related scrap (i.e., OEW) were recovered from BBR 2. These were about equally divided between tail fins from

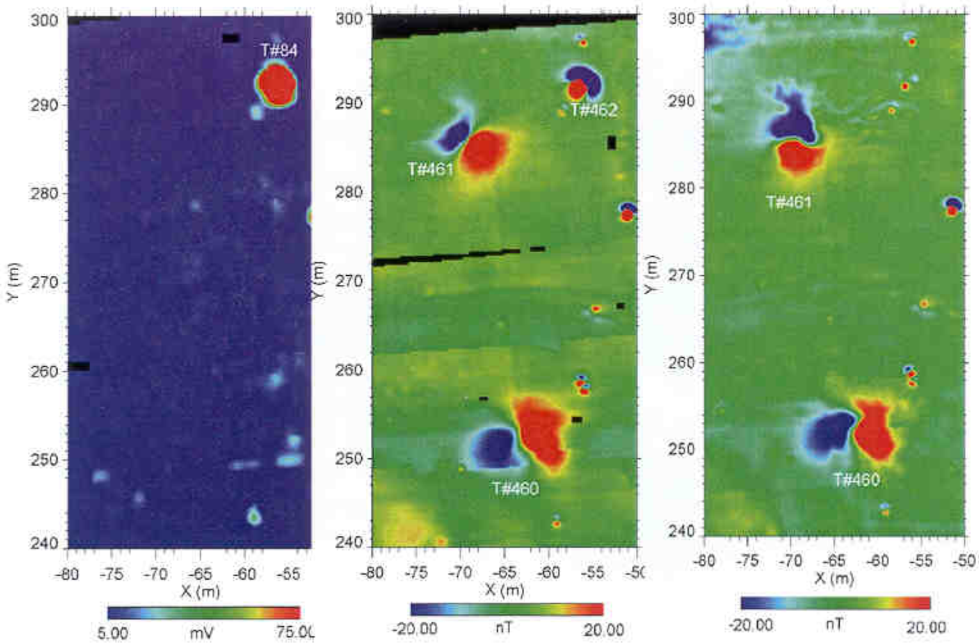


Fig. 29 — EM plot (left) and magnetic anomaly plot (center) of two geophysical anomalies. The rightmost plot is a repeat of the magnetometer survey following remediation

bombs and rockets and scrap from the disintegration of these items. Only one smaller ordnance item was recovered — a 20-mm projectile that was buried about 20 cm deep. Twenty-four other scrap items were recovered that were not classified as OEW. The majority of these were wire or metal strapping.

The mix of ordnance at BBR 2 is much more heterogeneous than that found at BBR I. However, as at BBR I, the only items that were found that present any danger are the M 38 targets that have intact and undetonated spotting charges. Because of the density of ordnance and clutter near the center of the target, we cannot estimate with confidence the likely number of ordnance with undetonated spotting charges. However, the number likely lies between 5 and 20 within 300 m of the center of the target. Our coordinate positions for the targets would allow them to be remediated in all surveyed areas except the 25 by 40-m area near the center of the target, which is effectively saturated. To completely remediate this area, one would have to remediate the targets that can be waypointed, including the small scrap targets, and the area would have to be resurveyed. It is doubtful that doing so would be justified as this area has been cultivated for many years apparently without incident. It might be a good idea to fence off the 2 acres or so at the center of the target rather than continuing to cultivate it because of the possibility of setting off one of the spotting charges.

8.7 MTADS Performance Summary

The two largest impediments to progress in this operation were the nonseasonal weather and the extreme daily commute required to and from the site. The very rainy weather and subsequent very deep mud precluded surveying on 4 days and slowed down operations on 5 or 6 more days. This time was partially made up by working on some weekends. The overtime added expense to the remediation efforts of the commercial remediation team. The roundtrip commute required over 3 hours of driving time each day. This cut into the time available for onsite surveying and added expense to the costs paid to the commercial remediation company as they required payment for driving time and the inevitable overtime that this created. Given these limitations, the overall performance exceeded our expectations in all categories except the raw number of acres surveyed.

The *MTADS* surveying that was carried out effectively and completely characterized two of BBR targets. One of these targets effectively was "found" by the *MTADS* crews during the time we were surveying the first target. Our approximate location for the target, combined with exploratory surveys, allowed the second target to be precisely located and completely characterized.

The *MTADS* data analysis processing stayed current within 24 hours of the survey data taking and stayed far enough ahead of the remediation teams to allow creation of target tables, dig lists, and dig images for remediation. The creation of the training data set was an excellent concept. The real-time feedback as digging began was very instructive in guiding the target analysis during the second half of the survey. From the information learned from the first 2 or 3 days of digging, we could have effectively dug only ordnance targets on BBR I if we had so chosen, and avoided almost completely digging further OEW on this site.

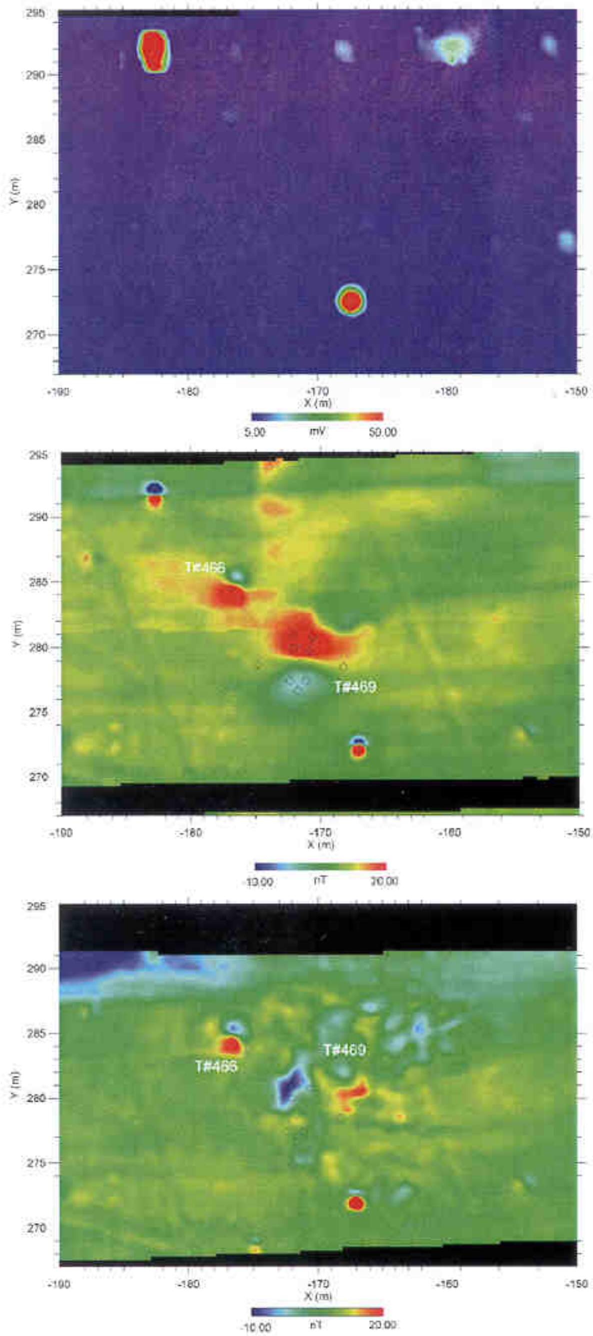


Fig. 30 — Display of two geophysical anomalies. The EM survey is shown at the top, the magnetometer image is in the center, and the magnetometer resurvey following excavation is at the bottom.

The second target had a wider range of ordnance present. However, assuming that one wished to remediate the 2.75-in. rocket warheads as the smallest ordnance targets, 25 to 40% of the targets dug on this site could have been excluded from the dig list. These observations have important implications for future survey/remediation operations. If one is willing to "learn" from a training data set, we strongly feel that a large fraction of OEW targets on DoD ranges need not be dug. One does not need to be able to classify a target as clutter if it can confidently be classified as "not ordnance."

The mix of resource commitments at this demonstration was very good. The field survey team of one driver (who is also UXO-certified to supervise other field persons) and a field support team of two to four persons (depending on field conditions) can keep the *MTADS* survey equipment busy. The field operations are supported by two data processors. One of these is responsible for data preprocessing and handing off target analysis to the second processor. Depending on the information load, these persons are responsible for target analysis and information processing for the waypointing and remediation crews. A two-man waypointing crew was kept busy staking out targets and reacquiring them after they were disclosed. If targets were not reacquired, this two-man crew would not stay busy with these tasks. The two, three-man remediation crews strained the output production rate of the data analysis crews. A single three-man remediation team would probably keep pace with the two-man data processing and analysis team if (this mix of) targets were remediated without reacquiring and carefully documenting each target. The production rate of the remediation crews will be highly influenced, however, by the presence of deep targets. The few targets deeper than 2 m required 2 to 3 h each to prosecute. During this time, 10 to 30 very shallow targets could be remediated.

This demonstration provided an excellent test of the position and depth locating abilities of the *MTADS*. Based on performances at Twentynine Palms and at JPG, we felt confident that *MTADS* could routinely locate targets within a 0.5-m circular radius and with a depth accuracy (based on magnetometer target fitting) of about 20%. These position accuracies may have, in part, been limited by the baseline truth for each of these sites. The target waypointing and target reacquisition accuracies, based on the current GPS protocols, each have an uncertainty of about 5 cm. The demonstration at the BBR should provide a much more stringent test of the *MTADS* DAS target-fitting algorithms and of our ability to put a flag over a target in the field.

Figure 31 shows a histogram of the *MTADS* target-locating ability for all targets dug on both of the sites. The "dry holes" are not included in the figure. The average target location error was 12 cm, 90% of all targets were located within 22 cm, and 95% of all targets were located within 29 cm. The few outlying points likely do not represent location errors, but rather identification of the wrong targets by the remediation team or location of small surface targets that were moved by the *MTADS* during survey or by the remediation team while prosecuting nearby targets.

The ability of MTADS to precisely locate the positions of targets has been conclusively demonstrated. This is true for small targets on the surface, for deeper targets including many deformed M 38s, and for the 250-lb bombs at more than 2 m. In almost all cases, the location error of the target is smaller than the dimensions of the target.

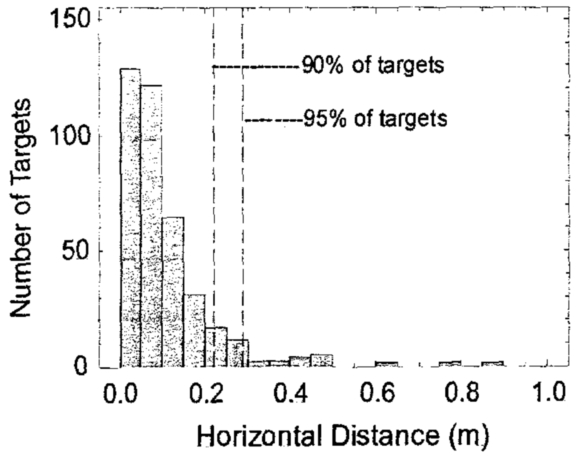


Fig. 31 — Histogram plot of the horizontal miss distance between the analyzed and measured target positions

Figure 32 is a plot of predicted vs reported target depth for all remediated targets. There is a very high correlation between the predicted and measured depths. For most targets significantly below the surface, the error in the depth prediction is a small fraction of the observed depth. On a fraction of depth basis, many of the shallow targets are not as precisely located. Many of the shallower targets are clusters of scrap whose average depth is not easily evaluated. In other cases, comparisons of near-surface target depths with predicted depths involves uncertainties about where the surface of the ground is. For remediation purposes, it is irrelevant whether a target is located at a depth of 4 or 7 cm. In general, the magnetometer-based depth predictions are highly precise and provide excellent information for the remediation team to plan and execute target recoveries. As with the position accuracies, the depth predictions generally fall within the dimensions of the targets. Based on all evaluation criteria, the *MTADS* demonstration, survey, and remediation were very successful.

9.0 SURVEY COST INFORMATION

The information in Table 2 summarizes our costs to complete the survey at the BBR. Not included in the table are costs associated with the planned operation at Air Force Retained Area, which did not take place. Those costs included development of the original Demonstration Work Plan, travel for three persons to South Dakota for meetings with the Air Force, and commercial establishment of survey points at the Air Force Retained Area.

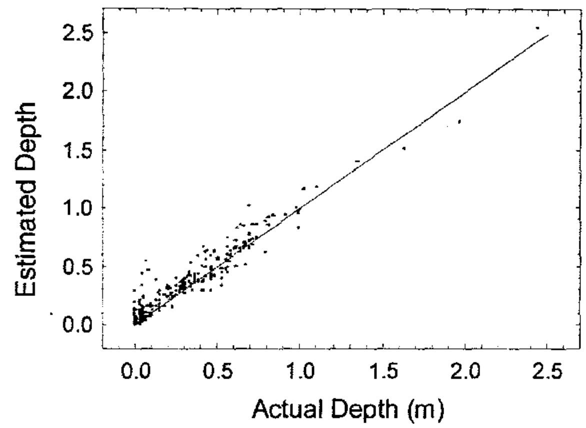


Fig. 32 — Comparison of the analyzed and measured target depths for all recovered targets

The costs for the survey that we conducted on Cuny Table are broken down into categories that allow us to estimate costs for additional similar *MTADS* surveys and for similar remediation exercises. Our survey costs should not be used to project ultimate costs to conduct a survey with a similar commercial system because we are continuing to do development in the field. Likewise, the remediation costs reflect travel costs for multiple teams and organizations and significant costs associated with paid overtime for Saturday work and the extended commute time. More importantly, the target documentation process required significantly more effort than would a simple remediation. Depending on the size of the site to clean up, remediation costs alone might be half of those reflected in Table 2.

10.0 COMPARISON OF *MTADS* AND "MAG AND FLAG" SURVEY COSTS

To date, the *MTADS* has been a development system, and, therefore, an objective analysis and comparison of operational and deployment costs relative to other survey methods (i.e., "Mag and Flag" operations) is not straightforward. We have undertaken an economic evaluation of the replacement costs for the *MTADS* hardware and software (as presently configured) to form the basis for a future life cycle cost analysis.

The replacement cost analysis is based on producing an exact copy of the *MTADS* field equipment and DAS hardware and support equipment. We assumed the same vendors and suppliers as originally used and acquisition costs for the same spares and ancillary support equipment that currently support *MTADS*. Based on these assumptions, the one-of-a-kind replacement cost is \$742,000.

There are several unrealistic assumptions in this estimate. The original computer hardware is no longer available and has been superseded by new models. Current analysis shows that our original reliance on high-

Table 2. Summary of Costs for the BBR Demonstration

SURVEY TASK	COST CATEGORY	COST SUBTOTAL	TOTAL TASK COST
Site Assessment			3,000
Base Station Survey			4,500
Site Survey			
	AETC, Labor, Travel, ODCs	42,720	
	GeoCenters, Labor, Travel, ODCs	28,162	
	Hughes, Labor, Travel, OCDs	18,726	
	NRL, Labor, Travel, ODCs	38,000	
	OST Tribal Labor	10,098	
	MTADS Transportation	5,874	
	Survey Cost		143,580
Remediation/Disposal			
	CEHNC-OE	107,000	
	Ordrem	62,096	
	Disposal Total		169,096
Logistics			
	Maps, generator, trailers, toilets, radios, tent, fuel, labor, and misc.	25,001	
	Property Damage	2,000	
	Logistics Total		27,001
GIS Development		6119	
Survey Report	NRL	20,000	
	Nova Research	4,000	
	Total Report Costs		24,000
GRAND TOTAL			377,296

end workstations can now be replaced by desktop PCs with no loss of operating capability, thus reducing both hardware and software licensing costs. The field hardware manufacturing costs are based on quotes from the original R&D firms that developed the equipment, rather than from hardware fabricators who could presumably work from our detailed engineering drawings. It is likely that a savings of $100K to $150K could be realized on the major field hardware components by competitive use of commercial manufacturers and fabricators.

Based on our experience in supporting and using the *MTADS* at three demonstrations over the past 2 years, and for the purposes of this study, we propose to amortize $400K of the *MTADS* costs based on a schedule of

4000 hours of surveys. We feel that this is a conservative estimate because our breakage, maintenance, and replacement costs for the past 2 years have been less than $25K. This translates to an assumed cost of $100 per survey hour for *MTADS* amortization costs.

In our past experience with *MTADS* at field operations, we have always had one senior scientist/supervisor on-site supporting the operation. In addition, we have provided extensive logistics support (such as tents for maintenance work, offices with bench spaces for repairs, and onsite office spaces for computers and DAS support equipment). It is our experience that these support elements have a positive impact on our survey efficiency, the quality of the data collected, and the on-site analysis product. For this reason, we have built in the same support and logistics costs for the following comparative study. A commercial firm in a cost-competitive environment might forego many of these logistics support costs.

The comparative study assumes various sized operations ranging from 15 acres up to a large 3000-acre survey. Because comparisons are being made with a hypothetical commercial "mag and flag" operation, we also assume that only the *MTADS* magnetometer array will be used and that the survey sites are not terrain limited. We assume that the hypothetical sites contain an average of 20 targets per acre and factor this into an assumed production rate of 1.5 acres per day for a "mag and flag" operator and an *MTADS* survey and analysis capability of 10 acres per day. Since only one *MTADS* exists, we assume a survey rate of 10 acres per day and provide travel costs to cycle *MTADS* personnel on a 30-day rotation. The *MTADS* surveys have a senior UXO technician on-site in the field at all times and assume HAZWOPR-certified field support staff typical of our past operations. Except for the smallest surveys, we also assume that two dedicated people support the data analysis and site supervisory functions.

For the "mag and flag" operations, we assume that the appropriate number of personnel are put on-site to complete the survey in 2 weeks. This minimizes travel and logistics costs. The labor mix of UXO technicians to UXO supervisors and the site-supervisor support and logistics support are typical of those that we have had quoted to support operations and also factor in information about labor rates and labor mixes typically quoted for operations similar to these.

Tables 3 and 4 are summaries of the assumptions made in making the cost comparisons for surveys ranging from 15 to 3000 acres, located at a distance of 2000 miles from the *MTADS* base of operations in Chesapeake Beach, MD. In the case of "mag and flag" operations, the personnel doing the survey are assumed to have similar travel requirements. No logistics costs are assumed for the "mag and flag" surveys except for the largest surveys, which have associated logistics support personnel. Similar hotel and per diem costs are assumed for each arm of the study.

Figure 33 is a graphical comparison of the relative costs for the hypothetical surveys. We assumed no remediation of targets. The *MTADS* survey has been carried through target analysis, providing target maps and target tables with depth and size information for all targets and target positions in global, state, plane, or local coordinates. The "mag and flag" surveyor is presumed to flag each target when it is detected. No permanent record is provided. Laying out a grid and surveying each target or measuring the coordinates of the flagged targets suitable for GIS integration will add an additional 30 to 50% to the cost of the "mag and flag" survey.

These calculations do not address the ultimate goal of any particular survey (i.e., is the survey being conducted to assist in remediation activities or simply to provide an indication of whether the site is contaminated and the extent of the ordnance contamination?). Previous studies of the detection efficiencies of "mag and flag" operations have shown that (at least for sites where ordnance exists below 1 m in depth), the majority of ordnance remains undetected. Studies conducted at the Magnetic Test Range at Twentynine Palms using EOD teams trained with Mk 26 detectors indicate that the detection efficiency for a "mag and flag" operation is approximately 35%. *MTADS* detection efficiencies at ordnance ranges including the Magnetic Test Range at Twentynine Palms, the three different ordnance scenarios at JPG, and these studies at the BBR indicate a detection efficiency exceeding 95%.

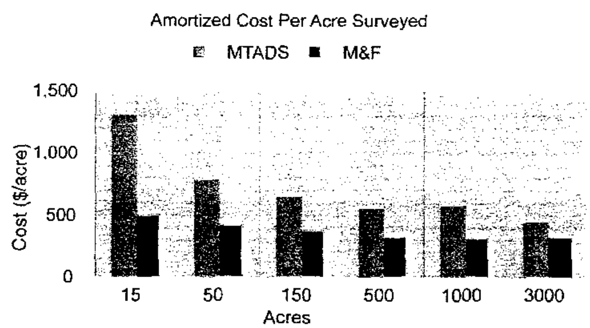


Fig. 33 — Cost comparison between *MTADS* and "mag and flag" surveys

Assuming that the survey is in support of a remediation activity, the cost per detected target is a useful comparison. Using the detection efficiencies cited above, Fig. 34 provides this comparison. Regardless of the size of the survey, *MTADS* is more cost effective in flagging targets for remediation. It should also be noted that following the remediation based on the "mag and flag" survey, 65% of the undetected ordnance remains in the ground.

These comparisons between *MTADS* and "mag and flag" surveys are based on complex sets of assumptions. No real operation will compare identically with these assumed conditions. Moreover, the survey products are

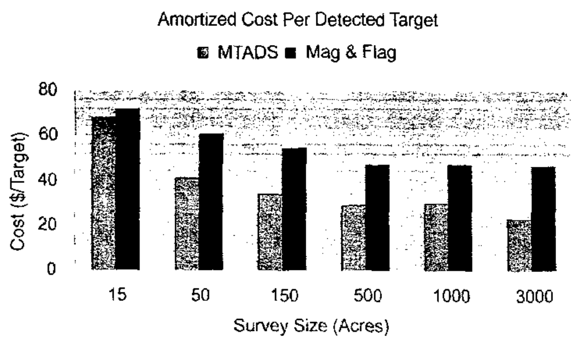


Fig. 34 — Comparison between MTADS and "mag and flag" surveys based on target detection costs

very different between the two approaches. The *MTADS* surveys provide a permanent record in global coordinates for all targets. The "mag and flag" survey provides a product that is only useful for immediate follow-on remediation. These approaches are most directly comparable when they are conducted only to define contaminated vs "clean" areas.

Table 3. Survey Cost Assumptions for Hypothetical *MTADS* Magnetometer Surveys

LABOR	BURDENED LABOR RATE ($/HR)	15 ACRES 2 DAYS	50 ACRES 7 DAYS	150 ACRES 15 DAYS	500 ACRES 50 DAYS	1000 ACRES 100 DAYS	3000 ACRES 300 DAYS
SUPERVISOR	$95	1 ($1,520)	1 ($3,800)	1 ($11,400)	1 ($38,000)	1 ($ 76,000)	1 ($228,000)
DATA ANALYST	$57	0 ($0)	0 ($0)	0 ($0)	0 ($0)	1 ($ 38,000)	1 ($136,800)
UXO SUPERVISOR	$57	0 ($0)	0 ($0)	1 ($6,840)	1 ($22,800)	1 ($45,600)	1 ($136,800)
HAZWOPR TRAINED STAFF	$22.80	0 ($0)	0 ($0)	2 ($5,472)	2 ($18,240)	2 ($36,480)	2 ($109,440)
LOGISTICS/ FIELD SUPPORT	$28.50	3 ($1,368)	3 ($3,420)	4 ($13,680)	4 ($45,600)	4 ($91,200)	4 ($273,600)
TOTAL LABOR COST :		**$2,888**	**$7,220**	**$37,392**	**$124,640**	**$287,280**	**$501,600**
TRAVEL @ $1000/PERSON		$4,000	$4,000	$8,000	$16,000	$27,000	$90,000
HOTEL @ $60/DAY		$480	$1,200	$7,200	$24,000	$54,000	$162,000
PER DIEM @ $75 /DAY		$600	$1,500	$9,000	$30,000	$67,500	$202,500
LOGISTICS SUPPORT		$10,000	$20,000	$20,000	$30,000	$35,000	$60,000
AMORTIZATION CHARGE @ $100/ACRE		$1,500	$5,000	$15,000	$50,000	$100,000	$300,000
TOTAL SURVEY COST:		**$19,468**	**$38,920**	**$96,592**	**$274,640**	**$570,780**	**$1,316,100**

Table 4. Survey Cost Assumptions for Hypothetical "Mag and Flag" Surveys

LABOR	BURDENED LABOR RATE ($/HR)	15 ACRES 5 DAYS	50 ACRES 7 DAYS	150 ACRES 10 DAYS	500 ACRES 17 DAYS	1000 ACRES 17 DAYS	3000 ACRES 17 DAYS
SITE SUPERVISOR	$64	1 ($2,650)	1 ($3,584)	1 ($5,120)	1 ($8,704)	1 ($8,704)	1 ($8,704)
DATA ANALYST	$57	0 ($0)	0 ($0)	0 ($0)	0 ($0)	0 ($0)	0 ($0)
UXO SUPERVISOR	$57	0 ($0)	0 ($0)	2 ($6,144)	4 ($20,890)	8 ($41,779)	25 ($130,560)
UXO SPECIALISTS	$28.80	1 ($1,152)	4 ($6,451)	8 ($18,432)	16 ($62,669)	32 ($125,338)	100 ($391,680)
LOGISTICS/ FIELD SUPPORT	$28.50	0 ($0)	0 ($0)	0 ($0)	0 ($0)	1 ($3,264)	2 ($6,528)
TOTAL LABOR COST :		**$3,712**	**$10,035**	**$29,696**	**$92,262**	**$179,085**	**$537,472**
TRAVEL @ $1000/PERSON		$2,000	$5,000	$11,000	$21,000	$41,000	$128,000
HOTEL @ $60/DAY		$600	$2,100	$6,600	$21,420	$41,820	$130,560
PER DIEM @ $75 /DAY		$750	$2,625	$8,250	$26,775	$52,275	$163,200
LOGISTICS SUPPORT		$500	$1,500	$2,000	$3,000	$6,000	$20,000
AMORTIZATION CHARGE @ $100/ACRE		$0	$0	$0	$0	$0	$0
TOTAL SURVEY COST:		**$7,562**	**$21,260**	**$57,546**	**$164,457**	**$320,180**	**$979,232**

Appendix A

LETTERS OF PERMISSION FOR CONDUCTING DEMONSTRATION SURVEYS

Oglala Sioux Tribe

Box H
Pine Ridge, South Dakota 57770
(605) 867-5821
Fax: (605) 867- 1373

Office of the President
JOHN YELLOW BIRD STEELE

July 14, 1997

Mr. J.R. McDonald
Department of the Navy
Naval Research Laboratory
Chemical Dynamics and Diagnostics Branch - Code 6110
4556 Overlook Ave., SW
Washington, DC 20375-5320

Dear Mr. McDonald:

I am authorizing the Naval Research Laboratory (NRL) permission to conduct a survey and recovery demonstration of the area, Township 41N, Range 46W, Sections 9,10,and 11 within the boundaries of the former Badlands Bombing Range with the approval of the OST Land Office and Badlands National Park Service.

This area contains two military targets built in the 50's and some of the area surrounding the targets is currently under agricultural use. I would require that in those areas where intrusive procedures are carried out that restoration activities will take place to ensure the previous condition is attained.

If you have any questions, please call me at 605/867-5821 or Emma Featherman-Sam at 605/867-1271.

Sincerely,

John Yellow Bird Steele

John Yellowbird Steele
President

cc: Tom Conroy, Chairman, OST Land Committee
Emma Featherman-Sam, Director, BBRP
William Supernaugh, Superintendent, BNPS

United States Department of the Interior

NATIONAL PARK SERVICE
Badlands National Park
P.O. Box 6
Interior, South Dakota 57750

IN REPLY REFER TO:
July 14, 1997

L76

Mr. J.R. McDonald, Head
Chemical Dynamics and Diagnostics Branch
Chemistry Division, Code 6110
Department of the Navy
Navy Research Laboratory
4555 Overlook Avenue SW
Washington, DC 20376-5320

Dear Mr. McDonald:

I was contacted by Emma Featherman-Sam and Keena Clausen of the Badlands Bombing Range Project about your request to use a multi-sensor towed array device (MTADS) on park managed lands within the South Unit. The intent is to conduct a survey and recover unexploded ordnance (UXO) from the area identified as T41N R46W, Sections 9, 10, and 11 during the period July 14 through August 30. Part of the recovery operation entails detonation of UXO in place.

Badlands staff have been an integral part of the Restoration Advisory Board for the last several years. We support the efforts of this group and are interested in providing a safer environment for visitors and researchers and believe that your activity is compatible with our mandate to manage tribal lands for park purposes. Through this letter we sanction this operation, subject to the following conditions:

permission from the Badlands Bombing Range Project (BBR), Oglala Sioux Tribe (OST) Land Committee, and Bureau of Indian Affairs (BIA), who have interests for activities in this location

operation of MTADS and detonation of UXO in accordance with the Corps of Engineers site safety and health plan and environmental assessment for bombing range activities

48 hour prior notification of periods when you intend to use the MTADS

exclusion of visitors at the time areas are being surveyed

avoidance of damage to cultural resources identified by BBR, OST, BIA, and which includes the homestead site and grave of A. A. Binck

any markers used to designated sites will be removed by the end of the field study period

all excavated areas shall be restored by filling in the excavations and otherwise leaving the area in as near to original condition and contour as is practical.

If you have any additional questions, please contact Scott Lopez, Chief of Visitor Protection (433-5230), about questions relating to visitor activities, explosives, and monitoring operations, Chief of Resource Education Marianne Mills (433-5240) on cultural resources, and Bruce Bessken (433-5260) or Glenn Plumb (279-2464), natural resource managers, on natural resource or environmental compliance issues.

Sincerely,

W R Supernaugh

William R. Supernaugh
Superintendent

cc: Emma Featherman-Sam, Badlands Bombing Range Project
Robin White, Oglala Sioux Tribe Land Committee
Robert Ecoffey, Bureau of Indian Affairs
Scott Lopez, Badlands National Park
Glen Livermont, Badlands National Park
Gerald Roy, Badlands National Park
Marianne Mills, Badlands National Park
Bruce Bessken, Badlands National Park
Glenn Plumb, Badlands National Park
Robin Russell, researcher, Badlands National Park
Scot Ferguson, researcher, Badlands National Park

Appendix B

DATA ANALYSIS TABLES AND TARGET REMEDIATION TABLES

Table 5. Target Analysis of the Magnetometry Survey for the North Side of BBR I.

Target ID	Local X (m)	Local Y (m)	Depth (m)	Size (m)	Moment	Inclin.	Azim.	Fit Quality	Analyst Comments
1	261.97	13.57	0.04	0.062	0.13295	25	349	0.9814	Partial signature, surface scrap
2	246.03	19.30	0.08	0.052	0.07875	9	17	0.9768	Surface Scrap?
3	242.73	20.58	0.05	0.025	0.00860	16	156	0.9333	Inverted Signature, surface scrap
4	205.57	37.42	0.08	0.063	0.14564	23	53	0.9476	Very shallow
5	191.30	40.69	0.02	0.079	0.28086	54	355	0.8889	surface trash, 2.5 m ESE of another target
6	189.08	41.57	0.07	0.068	0.17713	22	344	0.9646	surface trash, 2.5 m WNW of paired target
7	183.18	31.34	0.55	0.169	2.75387	85	359	0.9953	classical target, perfect fit
8	180.72	7.40	0.61	0.144	1.70168	70	349	0.9942	target at north edge of road
9	170.49	12.43	0.37	0.178	3.22676	73	6	0.9934	large target, pretty shallow
10	173.14	19.68	0.04	0.028	0.01266	0	132	0.9789	surface trash, inverted signatue
11	175.61	33.77	0.06	0.022	0.00612	-2	264	0.8599	inverted signature, 20mm round?
12	155.00	43.01	0.75	0.137	1.47562	58	348	0.9792	good target
13	147.68	43.60	0.73	0.192	4.01428	65	6	0.9807	great target
14	156.90	16.03	0.26	0.138	1.51405	-44	31	0.5368	west-most of several pieces of clutter. look 2 m E
15	144.36	9.36	0.07	0.040	0.03631	67	354	0.9721	probably surface clutter
16	135.92	5.56	0.28	0.208	5.16691	73	356	0.9924	north edge of road
17	141.61	28.89	0.18	0.042	0.04112	87	90	0.7795	clutter in shadow of large targ, 2m south
18	141.10	26.87	0.56	0.130	1.25173	66	35	0.9886	good targ, surface clutter 2m N and 1.5m E
19	138.87	32.13	0.07	0.036	0.02559	21	311	0.9635	small targ, near surface
20	135.85	34.07	0.10	0.041	0.03889	14	45	0.9510	small shallow targ
21	135.74	31.99	0.16	0.033	0.01977	77	82	0.8725	20mm shell?
22	127.46	32.27	0.06	0.033	0.02026	25	12	0.9180	20mm?
23	132.32	31.77	0.07	0.052	0.08193	27	8	0.9742	clutter on surface?
24	127.04	10.54	0.77	0.164	2.49850	92	270	0.9772	see also small targ 2m SW
25	125.24	8.22	0.06	0.035	0.02346	12	343	0.9512	20mm?
26	110.60	26.36	0.04	0.056	0.09768	10	13	0.9940	surface clutter?
27	111.46	22.00	0.04	0.042	0.04088	11	1	0.9778	surface clutter?
28	108.09	22.29	0.95	0.161	2.38421	49	18	0.9623	good target, see clutter 2m E and 3m NE
29	101.79	8.12	0.03	0.048	0.06160	-2	12	0.9772	surface clutter
30	95.64	15.79	0.11	0.083	0.32678	4	333	0.9622	near surface
31	93.26	23.40	0.15	0.104	0.63525	2	348	0.8471	near surface
32	88.26	19.51	0.07	0.041	0.03805	20	339	0.9719	near surface
33	89.98	21.31	0.13	0.038	0.03047	1	24	0.7981	small shallow

Table 5. Continued

Target ID	Local X (m)	Local Y (m)	Depth (m)	Size (m)	Moment	Inclin.	Azim.	Fit Quality	Analyst Comments
34	89.74	24.00	0.03	0.076	0.25155	39	351	0.9733	on surface
35	91.16	28.17	0.00	0.056	0.10095	52	12	0.8594	on surface
36	91.25	32.43	0.00	0.094	0.47337	34	356	0.8421	on surface
37	82.57	35.10	0.73	0.143	1.67040	99	30	0.9860	good target
38	81.57	30.78	0.12	0.047	0.05836	32	357	0.8681	near surface, see big targ. 3 m SW
39	79.44	28.49	1.10	0.199	4.46433	63	343	0.9843	east side of berm
40	83.32	11.58	0.10	0.089	0.40768	26	354	0.9347	near surface, east edge of berm
41	74.36	1.13	0.05	0.063	0.13918	23	185	0.8813	surface trash, middle of road
42	62.63	0.83	0.06	0.040	0.03671	79	143	0.9617	surface trash in middle of road
43	60.32	1.72	0.29	0.130	1.25800	107	244	0.9769	good target, under right track of road
44	66.41	6.20	0.00	0.025	0.00925	30	28	0.8282	surface trash
45	71.20	8.08	0.09	0.038	0.03209	9	345	0.9508	near surface
46	60.58	9.25	0.05	0.040	0.03629	47	13	0.8252	surface clutter?
47	68.50	15.37	0.11	0.032	0.01937	30	17	0.8989	20mm?
48	67.51	17.35	0.10	0.049	0.06863	30	33	0.9709	near surface
49	66.82	18.89	0.16	0.047	0.05732	35	4	0.7433	small near surface
50	60.62	19.58	0.39	0.158	2.26099	67	29	0.9533	good target
51	61.48	23.00	0.82	0.131	1.28034	44	347	0.9227	good target, with fins to the E
52	72.27	22.39	1.15	0.177	3.16746	56	255	0.9431	deep target, fair fit
53	57.39	26.23	0.03	0.031	0.01745	25	51	0.9489	20mm on surface?
54	58.09	29.32	0.09	0.033	0.01982	19	14	0.8122	20mm?
55	69.82	29.48	0.66	0.175	3.04428	54	298	0.9737	good targ, on top of berm
56	72.08	35.35	0.90	0.209	5.22276	57	9	0.9745	good target, top of berm
57	63.43	40.51	0.25	0.049	0.06591	7	318	0.8101	small, shallow
58	57.69	41.20	0.00	0.039	0.03359	76	144	0.8118	surface trash
59	51.43	41.49	0.11	0.091	0.42856	13	47	0.9355	shallow target
60	49.33	35.96	0.63	0.141	1.58315	122	259	0.8554	target lies near east-west, clutter to N and E
61	46.66	30.26	0.42	0.153	2.03982	65	358	0.9760	good target
62	42.77	28.74	0.62	0.164	2.49278	72	33	0.9846	good target
63	43.69	25.21	0.16	0.055	0.09408	93	5	0.7082	poor fit
64	49.02	13.86	0.54	0.132	1.31190	68	5	0.9803	good target with clutter target 1m to SE
65	52.60	12.85	0.08	0.041	0.03824	24	15	0.7664	poor fit, multiple targets?
66	46.97	8.83	0.00	0.038	0.03155	28	356	0.6714	surface trash

Table 5. Continued

Target ID	Local X (m)	Local Y (m)	Depth (m)	Size (m)	Moment	Inclin.	Azim.	Fit	Analyst Comments
67	42.68	5.96	0.93	0.136	1.44685	80	165	0.9837	fairly large & deep, nose down?
68	34.99	-0.19	0.10	0.066	0.16247	33	110	0.9681	partial signature, left tire track of road
69	35.78	7.63	0.10	0.054	0.08920	20	47	0.9572	small, near surface
70	40.15	17.35	0.67	0.142	1.64347	91	39	0.9891	large target, nose down, small targ 1.5m east
71	37.88	17.43	0.00	0.048	0.06270	83	188	0.8977	surface trash half way between two large targs
72	34.74	19.17	0.41	0.197	4.34243	62	359	0.9478	good target
73	33.12	22.58	0.63	0.176	3.12610	96	262	0.9770	good target
74	22.01	4.16	0.64	0.186	3.69473	31	8	0.8304	good target, with clutter 2m E and 3m N
75	21.15	7.57	0.08	0.063	0.14408	11	346	0.9788	surface trash?
76	26.19	8.87	0.05	0.042	0.04130	-1	18	0.9097	small shallow
77	23.87	15.31	1.75	0.317	18.22823	96	358	0.9676	deepest target, nose down, clutter 1m to SE
78	22.11	22.42	0.55	0.207	5.03637	59	36	0.9841	good target with sm targ 2m to E
79	24.60	21.17	0.11	0.058	0.11000	4	354	0.8859	near surface, paired with targ 78
80	19.64	20.56	0.57	0.192	4.02390	108	251	0.8812	two small targets paired 1m to the W
81	27.28	28.02	0.20	0.144	1.68897	90	90	0.9693	good target with severalothers nearby
82	26.40	30.09	0.87	0.260	10.01976	93	312	0.8483	good target with others nearby to E & S
83	21.99	31.37	1.00	0.216	5.77156	102	228	0.9694	large target nearly nose down, sm clutter 1 m N
84	31.15	40.16	0.49	0.185	3.58761	41	343	0.9238	likely 2 or 3 targets, see large targ 1m W
85	29.17	39.08	0.67	0.225	6.51744	62	15	0.9726	other large targets 2m to the E
86	22.86	38.78	0.55	0.189	3.86722	58	22	0.9149	includes 4 nearby clutter targets to S, E and NW
87	20.08	41.38	0.03	0.067	0.16904	21	342	0.6797	surface clutter with other clutter 1m to W
88	16.49	13.00	0.05	0.049	0.06777	6	27	0.9242	surface trash
89	15.61	4.33	0.72	0.162	2.44364	55	38	0.8470	target has clutter 1m N and 2m S
90	12.38	0.18	0.55	0.158	2.26905	65	24	0.9627	target in lest side of the road
91	4.29	-0.42	0.89	0.193	4.10971	95	90	0.5356	targ in the road with two clutter targs 2m to W
92	-7.66	-1.75	0.62	0.127	1.17491	22	70	0.8915	partial signature, target in the road
93	-0.76	2.13	0.05	0.062	0.13639	4	352	0.9711	small target on surface
94	4.42	1.95	0.85	0.152	2.01420	45	186	0.8572	poor fit may be 2 targets
95	1.67	6.12	1.32	0.211	5.39084	71	157	0.8987	large targ with 3 clutter targs within 2 m
96	2.23	12.93	0.86	0.147	1.81169	70	332	0.9711	large target nose down, sm cluter targ 1m N
97	-6.00	8.69	1.22	0.253	9.23237	54	32	0.8952	there is a second target 1m W
98	-3.05	12.85	0.24	0.075	0.23988	-9	182	0.9593	inverted signal, unlikely ordnance
99	-10.26	11.95	0.82	0.158	2.26705	80	39	0.9253	good target with poor fit

Table 5. Continued

Target ID	Local X (m)	Local Y (m)	Depth (m)	Size (m)	Moment	Inclin.	Azim.	Fit Quality	Analyst Comments
100	-6.29	13.84	0.85	0.144	1.69195	51	160	0.7684	probably two targets, may be shallower
101	-4.32	14.93	0.78	0.153	2.04039	62	5	0.9777	good target
102	12.06	14.60	0.81	0.195	4.19961	79	316	0.9179	large target, poor fit, may not be nose down
103	12.24	18.74	0.20	0.133	1.33289	43	317	0.8963	good target with poor fit
104	11.93	21.98	0.32	0.123	1.06442	17	357	0.9228	note other large targets to S & W
105	9.12	22.06	0.49	0.154	2.09064	57	18	0.9776	good target
106	1.57	19.60	0.78	0.164	2.51228	57	45	0.8980	good target with small clutter 1m E
107	-2.34	18.77	0.89	0.215	5.64428	82	349	0.8888	good target with clutter targets 2m W and 3m NW
108	-7.12	24.96	0.46	0.169	2.74934	76	359	0.9556	good target with clutter target 2m N
109	-7.10	27.34	0.12	0.066	0.16348	104	312	0.9209	trash
110	-3.73	26.19	1.06	0.197	4.35829	124	121	0.9838	good target
111	-1.41	25.62	0.00	0.068	0.18017	18	350	0.9375	surface trash
112	3.00	26.24	0.40	0.103	0.61989	13	30	0.8011	poor fit
113	6.85	25.74	0.07	0.090	0.41590	26	16	0.9578	small near surface
114	7.02	27.54	0.16	0.111	0.78958	47	334	0.9159	small near surface
115	6.65	29.64	0.46	0.162	2.43591	10	350	0.9732	good target
116	3.33	28.61	0.46	0.093	0.45976	4	11	0.8429	poor fit
117	2.96	31.77	0.22	0.119	0.97149	24	16	0.9604	good target
118	-6.02	32.25	0.99	0.167	2.67401	98	175	0.9852	good target, nose down
119	1.62	37.45	0.58	0.109	0.74696	59	35	0.9262	good target
120	0.76	40.96	0.91	0.219	5.95786	62	69	0.9612	good target
121	-6.26	38.44	0.67	0.166	2.59988	67	19	0.9070	note other large targ 2m W
122	-8.71	37.92	0.55	0.188	3.76517	94	55	0.8794	poor fit, note other large targ 2m E
123	-17.62	36.14	0.55	0.182	3.42206	51	24	0.9913	good target
124	-14.42	30.67	0.75	0.155	2.10403	73	62	0.9787	good target, small clutter 1m E
125	-15.91	26.37	0.66	0.162	2.43450	91	103	0.9381	good target, see sm target 1m NE
126	-15.51	21.03	0.50	0.288	13.55898	62	6	0.9799	large target near surface
127	-15.92	14.48	0.63	0.196	4.30151	89	86	0.9463	good target, poor fit
128	-18.33	9.22	0.60	0.154	2.06613	70	49	0.9825	large clutter object located 1m to SE
129	-15.81	0.61	0.57	0.132	1.31159	-18	13	0.9733	good target
130	-18.96	-0.09	0.63	0.135	1.41435	36	315	0.9718	good target under right tire on road
131	-24.01	4.45	0.71	0.208	5.15369	94	320	0.8598	second small target 0.5m to NW
132	-28.91	4.08	0.29	0.229	6.82867	53	347	0.9677	good target

Table 5. Continued

Target ID	Local X (m)	Local Y (m)	Depth (m)	Size (m)	Moment	Inclin.	Azim.	Fit	Analyst Comments
133	-29.40	7.68	0.32	0.210	5.29637	35	3	0.9885	good target
134	-31.56	9.56	0.58	0.144	1.68991	60	53	0.9823	good target
135	-36.76	12.93	0.88	0.194	4.15548	70	353	0.9788	good target
136	-35.05	16.22	0.76	0.166	2.59721	68	130	0.9302	good target, small clutter targs 1m to S and W
137	-30.84	15.84	0.41	0.274	11.78379	61	344	0.9718	good target
138	-26.68	17.15	0.52	0.226	6.62468	69	36	0.9738	good target
139	-23.91	14.77	0.75	0.158	2.23659	82	342	0.9854	good target, nose down
140	-22.95	17.04	0.40	0.222	6.21389	119	153	0.9758	good target
141	-27.25	19.04	0.36	0.199	4.50404	79	51	0.9643	god target
142	-20.53	21.84	0.58	0.151	1.94499	88	332	0.9438	good target, sm clutter target 1m to W
143	-21.92	28.99	0.29	0.221	6.14815	33	354	0.9860	good target
144	-25.69	24.23	0.03	0.052	0.07845	25	346	0.9037	sm targ on surface
145	-29.90	23.59	0.35	0.114	0.85085	101	146	0.9672	good targ, nearly nose down
146	-32.69	22.37	0.00	0.048	0.06356	23	26	0.9698	surface trash
147	-31.78	27.78	0.36	0.082	0.31316	35	4	0.8216	small target, with clutter targets 0.5m N
148	-28.22	29.25	0.10	0.063	0.14122	12	321	0.9486	small target near surface
149	-26.56	30.76	0.70	0.150	1.91990	63	19	0.8788	good target with several clutter 0.5m N
150	-29.45	35.37	0.34	0.204	4.84323	53	338	0.9774	good target with second target 1m to NE
151	-28.20	36.28	0.51	0.152	1.99119	89	225	0.8775	poor fit because of targ 150, 1m SW
152	-26.06	39.20	0.04	0.077	0.26442	0	352	0.9767	small target on surface
153	-31.69	39.35	0.08	0.046	0.05555	20	0	0.9499	small target near surface
154	-32.61	34.94	0.08	0.054	0.08718	38	8	0.9352	likely trash on surface
155	-36.58	33.21	0.33	0.162	2.40233	57	57	0.9942	good target
156	-38.78	42.18	0.07	0.073	0.22407	14	16	0.9815	sm target on surface
157	-37.34	29.68	0.03	0.039	0.03479	23	18	0.9720	30mm on surface
158	-40.19	5.99	0.10	0.079	0.27919	21	4	0.9883	small target on surface
159	-41.36	18.47	0.03	0.050	0.07120	7	0	0.9705	surface trash
160	-37.00	28.30	0.10	0.037	0.02975	79	118	0.7383	trash at 10 cm
161	-44.28	12.33	0.00	0.046	0.05659	1	6	0.8690	trash on surface
162	-51.65	13.34	0.17	0.089	0.40488	21	31	0.7780	small shallow target
163	-55.07	3.52	0.68	0.182	3.44473	76	349	0.9584	good target
164	-56.66	10.14	0.93	0.161	2.36131	82	33	0.9365	good target nose down
165	-61.62	11.07	0.83	0.177	3.17716	60	9	0.9828	good target

Table 5. Continued

Target ID	Local X (m)	Local Y (m)	Depth (m)	Size (m)	Moment	Inclin.	Azim.	Fit Quality	Analyst Comments
166	-71.14	2.19							surface trash
167	-71.85	13.89	0.21	0.060	0.11991	10	5	0.9407	small target E edge of berm
168	-76.94	19.51	0.91	0.153	2.05852	48	324	0.9461	good target, W edge of berm
169	-71.21	22.87	1.28	0.123	1.05241	37	106	0.9411	deep target on top of berm
170	-74.91	26.77	0.00	0.066	0.16684	31	347	0.9230	surface trash
171	-57.20	23.30	0.31	0.198	4.43522	61	5	0.9927	good target
172	-52.18	22.03	0.58	0.169	2.73673	75	15	0.9814	good target
173	-54.14	26.08	0.09	0.062	0.13633	34	45	0.9729	small targ on surface
174	-48.37	28.02	0.09	0.044	0.04965	20	358	0.9544	small target near surface
175	-57.34	30.04							sm targ near surface
176	-59.79	35.30	0.00	0.050	0.06993	16	2	0.9421	surface trash
177	-52.67	39.86	0.27	0.211	5.31961	63	343	0.9869	big target near surface
178	-57.85	38.11	0.69	0.208	5.14055	79	41	0.9748	good target
179	-60.59	39.78	0.01	0.054	0.08768	34	46	0.9805	trash on surface
180	-61.96	38.56	0.15	0.054	0.09147	6	22	0.9167	small target near surface
181	-76.86	36.94	0.11	0.121	1.00135	24	34	0.7795	target near surface
182	-72.57	43.01	0.17	0.056	0.10069	16	345	0.9214	small target near surface
183	-73.47	43.76	0.20	0.071	0.20393	103	79	0.7874	small target, poor fit
184	-77.26	43.11	0.45	0.173	2.95375	77	26	0.9867	god target
185	-91.33	37.70	0.08	0.058	0.11343	3	8	0.9075	sm targ, near surface
186	-108.42	38.14	0.72	0.156	2.15224	45	4	0.9844	good target, small clutter target 1m SE
187	-99.43	24.82	0.39	0.146	1.77065	56	349	0.9857	good target
188	-84.91	19.30	0.12	0.110	0.74925	-28	328	0.7963	several clutter targets near surface
189	-87.92	17.87	0.15	0.037	0.02860	92	82	0.5003	small target near surface
190	-88.84	3.62	0.79	0.161	2.35737	63	37	0.9787	good target
191	-93.60	9.69	0.80	0.184	3.55972	48	355	0.9893	good target
192	-99.35	5.82	0.65	0.177	3.14242	79	351	0.9836	good target
193	-103.35	5.48	0.68	0.150	1.92744	80	114	0.9870	good target
194	-101.83	7.90	1.52	0.274	11.79607	74	123	0.9818	very large & deep, nose down
195	-106.85	13.83	0.41	0.165	2.55231	52	334	0.9558	god target, 4 sm clutter targets surround
196	-109.30	18.79	0.00	0.056	0.09847	11	349	0.9718	surface trash
197	-111.83	22.51	0.00	0.056	0.09993	5	18	0.9415	surface trash
198	-125.17	7.13	0.15	0.053	0.08682	2	359	0.7923	small shallow target, second target 1m E

Table 5. Continued

Target ID	Local X (m)	Local Y (m)	Depth (m)	Size (m)	Moment	Inclin.	Azim.	Fit Quality	Analyst Comments
199	-117.61	24.32	0.78	0.155	2.13971	72	341	0.9307	good target, nearly nose down
200	-153.88	27.93	0.48	0.170	2.78172	85	22	0.9746	good fit
201	-163.77	19.48	0.11	0.058	0.11144	18	40	0.8803	small targ, near surface
202	-161.25	21.40	0.08	0.041	0.03986	7	48	0.9541	surface trash
203	-162.37	18.57	1.03	0.141	1.60534	60	347	0.9664	large target
204	-162.82	5.99	1.46	0.101	0.58363	11	189	0.9444	inverted signal, poor fit, doubtful target
205	-162.82	5.99	1.46	0.101	0.58363	11	189	0.9444	small, near surface
206	-160.55	2.01	0.00	0.029	0.01434	64	67	0.6260	multiple targets on surface
207	-150.22	-3.06	0.00	0.043	0.04679	55	4	0.8372	small target on surface
208	-176.53	-4.33	0.03	0.040	0.03681	1	24	0.9833	small target on surface
209	-187.85	34.91	0.03	0.066	0.16584	0	332	0.9897	small target on surface
210	-204.33	25.43	0.52	0.125	1.10542	70	354	0.9853	good target, clutter target 0.5m W
211	-215.40	10.58	1.55	0.122	1.03911	-13	338	0.9454	medium target, deep with poor fit
212	-214.77	-5.64	0.00	0.026	0.00974	25	4	0.9645	trash on surface by the road
213	-238.64	30.76	0.07	0.044	0.04839	32	358	0.7902	small target near surface
214	-252.59	44.40	0.79	0.168	2.71049	53	334	0.9912	good target
215	-241.26	71.42	0.62	0.156	2.17968	57	24	0.9713	good target
216	-256.22	73.17	1.05	0.110	0.76795	98	357	0.8463	good target medium fit
217	-254.87	75.13	0.05	0.063	0.14098	35	355	0.9891	small target on surface
218	-247.54	79.37	0.06	0.033	0.02054	24	8	0.9508	20mm?
219	-254.36	81.90	0.08	0.025	0.00853	26	327	0.9280	20mm?
220	-242.66	81.63	0.09	0.026	0.00968	8	30	0.9006	20mm?
221	-215.86	46.02	0.05	0.033	0.02083	32	22	0.9839	20mm?
222	-226.03	77.37	0.04	0.025	0.00892	12	6	0.9433	20mm?
223	-192.72	66.17	1.40	0.112	0.80255	-2	45	0.9572	interesting deep target, 105mm?
224	-169.63	55.81	0.63	0.155	2.10640	74	2	0.9925	good target
225	-160.73	65.13	0.16	0.032	0.01915	42	17	0.9662	20mm?
226	-153.29	57.92	0.08	0.044	0.04751	2	356	0.9890	small targ, near surface, scrap?
227	-141.06	51.79	0.04	0.040	0.03527	5	29	0.9672	scrap on surface
228	-139.23	66.44	0.25	0.091	0.43379	-52	319	0.5247	three pieces of scrap lined up E-W
229	-129.16	59.30	0.06	0.035	0.02438	9	352	0.9883	20mm?
230	-127.15	59.24	0.06	0.032	0.01935	15	355	0.9634	20mm?
231	-136.70	48.29	0.06	0.032	0.01934	7	12	0.9542	20mm?

Table 5. Continued

Target ID	Local X (m)	Local Y (m)	Depth (m)	Size (m)	Moment	Inclin.	Azim.	Fit Quality	Analyst Comments
232	-116.59	54.96	0.09	0.039	0.03280	19	34	0.9854	sm target near surface
233	-115.11	66.58	0.08	0.035	0.02500	19	297	0.9566	smal targ near surface
234	-101.24	65.09	0.04	0.050	0.07044	22	8	0.9249	small targ near surface, second targ 1m SE
235	-96.94	64.27	0.01	0.035	0.02465	92	56	0.8791	scrap on surface
236	-96.88	61.25	0.01	0.093	0.46181	56	355	0.9550	scrap on surface
237	-100.29	59.56	0.35	0.132	1.32240	79	30	0.9787	good target
238	-92.95	45.79	0.06	0.044	0.04825	9	8	0.9550	small targ near surface
239	-92.17	52.60	0.05	0.063	0.13944	36	12	0.9163	scrap on surface, see second smaller targ 1m SE
240	-88.76	58.38	0.04	0.068	0.17555	28	1	0.9907	scrap on surface
241	-80.07	66.05	0.04	0.058	0.11023	6	8	0.9845	scrap on surface
242	-82.99	69.12	0.85	0.178	3.20837	109	151	0.9717	good target, with scrap 1.5m NE
243	-73.05	73.59	0.54	0.162	2.42748	70	8	0.9859	good target
244	-65.40	65.11	0.08	0.044	0.04710	7	46	0.9462	scrap near surface
245	-63.29	53.13	1.06	0.227	6.67144	107	197	0.7398	good targ on edge of berm, scrap 1m W
246	-52.87	55.52	0.70	0.173	2.95950	77	357	0.9725	god target on top of berm
247	-46.61	56.58	0.09	0.066	0.16394	8	7	0.8630	small targ at surface
248	-56.37	66.18	0.79	0.180	3.33145	61	347	0.9828	good target
249	-60.42	72.59	0.04	0.048	0.06140	19	46	0.8953	scrap on surface
250	-56.06	76.63	0.93	0.140	1.56957	74	36	0.9855	good targ, 2.5m S of second big target
251	-55.20	79.67	0.87	0.184	3.57985	95	234	0.9752	good target, see targ 250 nearby
252	-47.40	70.13	0.86	0.215	5.70597	76	346	0.9868	good target
253	-41.82	77.30	0.41	0.228	6.77971	67	345	0.9674	big target shallow
254	-29.90	81.41	0.02	0.053	0.08522	45	16	0.9702	trash on surface
255	-20.25	79.54	0.83	0.143	1.67140	50	343	0.9731	good target
256	-33.49	70.95	0.30	0.173	2.94812	50	54	0.8660	big target, very shallow
257	-30.27	65.75	0.72	0.133	1.35574	43	7	0.9522	good target
258	-25.30	63.81	0.93	0.166	2.61419	61	21	0.9769	good target
259	-23.21	56.06	0.06	0.089	0.39892	76	356	0.9323	scrap on surface
260	-24.19	54.49	0.12	0.091	0.43209	28	4	0.8961	scrap near surface
261	-22.94	48.62	0.60	0.110	0.75486	50	73	0.9503	medium target
262	-21.60	47.85	0.53	0.149	1.88841	63	358	0.9787	good target
263	-19.01	54.24	0.58	0.172	2.92580	77	21	0.9753	good target
264	-17.50	45.28	0.04	0.057	0.10461	17	28	0.8868	trash on surface

Table 5. Continued

Target ID	Local X (m)	Local Y (m)	Depth (m)	Size (m)	Moment	Inclin.	Azim.	Fit	Analyst Comments
265	-5.39	44.79	1.29	0.182	3.44848	93	235	0.9175	good target, several pieces of scrap to W
266	-7.04	49.78	0.23	0.146	1.79084	37	314	0.7846	large target with scrap above & N
267	-6.90	51.38	0.77	0.167	2.65550	44	340	0.7786	good target with second large targ 2m S
268	-7.04	57.88	0.00	0.058	0.11077	56	359	0.8196	trash on surface
269	-11.96	64.58	0.03	0.056	0.09890	34	28	0.9783	scrap on surface
270	-14.03	64.89	0.04	0.052	0.07931	94	85	0.8216	scrap on surface
271	-18.20	64.12	0.12	0.049	0.06770	6	6	0.9827	scrap near surface
272	-16.19	66.47	0.14	0.057	0.10466	12	32	0.8932	scrap near surface
273	-14.13	68.41	0.12	0.065	0.15725	12	20	0.9237	scrap near surface
274	5.15	47.76	0.89	0.155	2.10602	53	6	0.8335	good target, scrap to E & N
275	9.32	52.30	0.65	0.236	7.48089	51	336	0.8672	good target, careful of second target 1.5m E
276	8.86	56.56	0.53	0.094	0.47280	64	55	0.9493	medium target
277	19.06	45.26	0.50	0.128	1.20353	63	349	0.9955	good target, with large scrap 1m SE
278	19.06	45.26	0.50	0.128	1.20353	63	349	0.9955	scrap target, won't analyze
279	27.68	44.50	1.05	0.182	3.44806	94	358	0.9499	good target with scrap 1m NE
280	34.83	46.37	0.73	0.112	0.80990	87	329	0.9597	good target with scrap E & N
281	23.80	56.25	0.68	0.168	2.68575	52	350	0.8490	good target with four pieces of scrap N & W
282	29.22	61.94	0.50	0.192	4.01595	7	5	0.8876	good target, scrap on top S & SE
283	12.58	68.00	0.41	0.231	7.07091	49	354	0.9229	good target
284	11.98	74.26	0.66	0.160	2.33675	94	29	0.9732	good target, nose down inside edge of berm
285	18.58	70.69	0.67	0.090	0.42098	69	55	0.9705	good target
286	23.69	72.55	0.25	0.068	0.18038	5	224	0.9383	small target, inverted signal
287	30.02	67.92	0.95	0.151	1.95060	92	269	0.9654	good target
288	30.46	77.55	0.49	0.159	2.30911	61	3	0.9607	good target outside edge of berm
289	35.99	64.39	0.37	0.203	4.76019	71	360	0.9748	good target, scrap 2m NE
290	39.44	64.84	0.21	0.133	1.33993	44	336	0.7683	good target inside edge of berm
291	38.92	68.65	1.06	0.190	3.91491	89	333	0.9081	good target, top of berm
292	44.71	70.06	0.38	0.223	6.30167	93	252	0.9213	good target with large scrap 2.5m NE
293	54.13	58.11	0.82	0.160	2.32408	49	31	0.5733	two targets can't separate, top of berm
294	57.01	46.41	0.90	0.159	2.29041	94	329	0.9833	good tartget
295	60.55	53.45	0.79	0.155	2.13615	41	43	0.9705	good target outsede edge of berm
296	81.71	70.60	0.40	0.217	5.86712	58	49	0.9731	good target
297	83.28	60.26	0.29	0.179	3.28833	85	21	0.9754	shallow, nose down

Table 5. Continued

Target ID	Local X (m)	Local Y (m)	Depth (m)	Size (m)	Moment	Inclin.	Azim.	Fit Quality	Analyst Comments
298	88.75	69.86	0.02	0.053	0.08403	12	21	0.9718	surface trash
299	97.51	45.14	0.02	0.056	0.10168	8	12	0.9568	surface trash
300	113.24	68.85	0.62	0.167	2.64665	91	29	0.9688	good target
301	115.35	65.21	0.63	0.190	3.89780	104	49	0.9605	good target
302	110.87	55.03	2.69	0.239	7.76237	9	252	0.8201	very deep, but low probability as bomb
303	125.27	75.03	0.04	0.045	0.05220	25	352	0.9961	surface trash
304	130.00	76.88	0.68	0.163	2.48499	93	227	0.8472	good target, with clutter 0.5meter W
305	152.97	79.70	0.66	0.167	2.65538	63	42	0.9895	great target
306	175.38	76.03	0.05	0.068	0.17902	7	34	0.9845	surface trash
307	179.75	73.26	0.06	0.049	0.06505	2	346	0.9543	surface trash
308	193.47	58.61	0.37	0.082	0.30950	24	267	0.9677	small shallow
309	196.40	53.67	0.02	0.068	0.18271	33	14	0.9631	surface trash
310	214.01	66.62	0.48	0.176	3.10983	96	342	0.9658	good target, nose down
311	224.78	65.97	0.66	0.167	2.63920	69	10	0.9579	great target
312	223.68	69.57	0.05	0.060	0.12072	38	66	0.9439	scrap
313	212.02	62.82	0.09	0.069	0.18354	6	58	0.9908	clutter on top of outer berm
314	224.85	79.36	0.05	0.055	0.09460	12	342	0.9753	small targ on surface
315	238.90	95.96	0.05	0.051	0.07511	7	3	0.9950	small targ on surface
316	203.10	115.98	0.04	0.063	0.14248	11	4	0.9894	small targ on surface
317	163.19	116.62	0.02	0.084	0.34194	16	330	0.7820	small targ on surface
318	124.19	87.57	0.01	0.063	0.13928	46	44	0.9912	small targ on surface
319	90.29	89.78	0.04	0.057	0.10445	8	34	0.9962	small targ on surface
320	68.90	89.91	1.13	0.160	2.32442	86	24	0.9625	good target, nose down
321	74.93	102.86	0.06	0.052	0.07859	2	1	0.9918	small targ on surface
322	67.77	104.54	0.06	0.062	0.13620	13	348	0.9445	small targ on surface
323	75.60	120.21	0.70	0.147	1.81807	69	33	0.9853	good target, nose down
324	56.23	119.15	0.05	0.071	0.20657	81	3	0.8475	small target on surface
325	50.17	116.05	0.57	0.165	2.55913	73	8	0.9781	great target
326	38.17	117.88	0.33	0.192	4.06251	52	13	0.9849	good target, clutter 1m N, trash SW
327	35.66	122.14	0.07	0.055	0.09722	27	9	0.9670	small targ on surface
328	19.76	112.57	0.98	0.173	2.94551	61	8	0.9939	great target
329	21.77	119.31	0.04	0.070	0.19506	31	340	0.9700	small targ on surface
330	29.36	107.68	1.43	0.369	28.62070	95	214	0.9387	mother of all targets

Table 5. Continued

Target ID	Local X (m)	Local Y (m)	Depth (m)	Size (m)	Moment	Inclin.	Azim.	Fit	Analyst Comments
331	14.73	99.42	0.24	0.180	3.34558	98	16	0.9890	good target, nose down
332	20.88	89.01	0.64	0.197	4.35850	83	345	0.9844	good target
333	32.27	99.99	0.86	0.166	2.62163	92	166	0.9657	good target
334	4.94	84.43	0.48	0.190	3.90572	64	340	0.9512	good target
335	11.26	121.60	0.51	0.176	3.10006	73	23	0.9765	good target
336	1.25	117.91	0.41	0.180	3.34871	35	10	0.9546	good target, large clutter 1m E
337	-2.34	115.15	0.57	0.145	1.75436	72	337	0.9729	good target
338	-2.10	105.64	0.73	0.145	1.72152	84	288	0.9690	good target
339	-6.75	118.04	0.13	0.087	0.37533	26	350	0.9739	small target near surface
340	-10.21	118.68	0.46	0.176	3.12662	98	180	0.9130	good target, clutter SW
341	-11.46	115.97	0.43	0.170	2.79992	80	13	0.9862	good target, note targ 340 nearby to NE
342	-13.98	98.49	0.64	0.141	1.59639	52	15	0.9668	medium target, good fit
343	-14.08	96.36	0.74	0.154	2.07810	61	66	0.9812	good target, see nearby target to N
344	-6.73	90.35	0.75	0.136	1.44015	62	359	0.9804	good target
345	-9.81	89.53	0.03	0.056	0.10233	11	26	0.8258	small target on surface
346	-12.86	86.54	0.47	0.190	3.93707	67	26	0.9329	good target, many clutter targets to N
347	-17.66	86.42	0.18	0.056	0.10159	33	355	0.8888	small targ near surface
348	-22.86	87.22	0.11	0.053	0.08343	15	329	0.7438	small targ near surface
349	-26.36	84.03	0.18	0.073	0.22187	16	339	0.8153	medium target near surface
350	-28.42	87.49	0.04	0.055	0.09713	-2	8	0.9218	surface clutter
351	-22.73	98.17	0.34	0.076	0.24713	22	7	0.9685	small targ, medium depth
352	-25.90	99.53	0.06	0.088	0.38973	3	3	0.8703	chunk on surface
353	-23.63	110.94	0.60	0.169	2.73536	79	5	0.9829	good target
354	-34.76	109.91	0.76	0.149	1.89779	66	51	0.9884	good target
355	-36.07	119.34	0.30	0.178	3.20844	56	335	0.9808	good target
356	-44.98	106.62	0.13	0.063	0.14364	17	358	0.9842	small target, shallow
357	-56.16	106.96	0.87	0.146	1.79110	53	357	0.9847	good target
358	-68.31	90.10	0.72	0.140	1.57461	104	73	0.9533	good target nose down
359	-91.44	93.88	0.73	0.180	3.32923	79	19	0.9774	good target, clutter targets above N
360	-93.81	102.93	0.74	0.163	2.45515	67	5	0.9869	good target
361	-104.84	105.55	0.73	0.163	2.44818	48	14	0.9569	good target
362	-115.40	118.05	1.17	0.179	3.27726	65	40	0.9931	good target
363	-138.39	106.68	2.55	0.319	18.45947	102	2	0.9756	2000lb bomb (?), nose down

Table 5. Continued

Target ID	Local X (m)	Local Y (m)	Depth (m)	Size (m)	Moment	Inclin.	Azim.	Fit Quality	Analyst Comments
364	-143.25	113.16	0.13	0.144	1.70501	13	311	0.9729	good target
365	-223.10	91.50	0.28	0.185	3.61702	88	357	0.9608	good target
366	-247.60	107.50	0.02	0.053	0.08659	7	18	0.8654	trash on surface
367	-256.46	97.52	1.89	0.167	2.67606	11	7	0.9542	good target, serious deep
368	-269.09	86.34	0.93	0.150	1.90896	62	41	0.9899	good target
369	-201.33	159.33	0.55	0.179	3.25835	55	342	0.9911	good target
370	-156.53	156.52	0.49	0.173	2.93152	88	252	0.9607	good target
371	-140.68	128.11	0.15	0.117	0.91404	-6	50	0.9782	large chunk on surface
372	-65.61	127.46	0.56	0.173	2.94759	73	48	0.9885	good target
373	-44.02	149.95	0.17	0.134	1.38674	78	312	0.8891	good target, poor fit
374	-36.50	149.08	0.00	0.078	0.26620	34	343	0.9191	trash on surface
375	-27.13	137.81	0.04	0.083	0.32608	2	10	0.9538	small targ on surface
376	-19.51	134.61	0.06	0.068	0.18247	18	26	0.9922	trash on surface
377	-25.25	154.70	0.95	0.157	2.21410	60	328	0.9867	good target
378	-9.57	154.93	0.10	0.066	0.16611	12	13	0.9646	small targ, shallow
379	-4.72	156.74	0.83	0.129	1.23665	90	78	0.9570	good target
380	-15.63	142.35	0.21	0.072	0.21534	47	344	0.6760	multiple pieces of clutter
381	-15.63	142.35	0.21	0.072	0.21534	47	344	0.6760	small shallow targ
382	5.88	145.82	0.00	0.065	0.15323	40	360	0.7575	trash on surface
383	-1.18	137.21	0.48	0.158	2.26745	75	348	0.9898	good targ, clutter above and E
384	7.12	137.27	0.16	0.123	1.06258	8	22	0.9194	medium target, shallow
385	-7.58	127.39	0.42	0.198	4.41918	68	348	0.9738	good target, large clutter to SW and N
386	-5.84	125.62	0.29	0.115	0.86648	31	357	0.9787	paired with larger target to NW
387	-1.80	124.09	0.85	0.210	5.26687	73	28	0.9363	good target
388	28.10	138.65	0.08	0.069	0.18741	25	29	0.9736	small target on surface
389	45.47	131.97	0.93	0.149	1.89061	86	20	0.9789	good target, nose down
390	55.64	132.78	0.75	0.147	1.80543	52	41	0.9789	good target
391	60.92	145.01	0.03	0.063	0.14009	13	344	0.9903	clutter on the surface
392	47.77	161.95	0.37	0.197	4.37347	43	2	0.9943	good target, clutter to S
393	73.31	141.36	0.25	0.177	3.15363	102	145	0.9904	good target
394	81.29	139.14	0.44	0.176	3.09572	91	245	0.4263	poor fit , two targs overlap
395	78.27	126.54	0.97	0.224	6.39004	49	25	0.8953	good target
396	150.66	139.54	0.63	0.179	3.27995	68	54	0.9671	good target

Table 5. Continued

Target ID	Local X (m)	Local Y (m)	Depth (m)	Size (m)	Moment	Inclin.	Azim.	Fit Quality	Analyst Comments
397	177.66	124.69	0.70	0.156	2.16647	64	35	0.9488	good target, paired with one to E
398	181.88	125.62	0.60	0.173	2.95401	59	316	0.9672	good target paired with one to the W
399	224.53	142.30	0.45	0.157	2.19735	69	356	0.9879	good target
400	226.29	178.13	0.66	0.088	0.38421	5	126	0.9330	small target, fairly deep, inverted signal
401	1.00	1.00	1.00	1.000	1.00000	1	1	1.0000	small shallow target, will not fit
402	127.47	158.08	0.04	0.037	0.02876	9	31	0.9437	small targ on surface
403	93.42	186.90	0.00	0.058	0.10868	29	326	0.9709	small targ on surface
404	79.41	185.97	0.00	0.046	0.05363	62	353	0.8649	small targ on surface
405	77.47	189.38	0.45	0.158	2.23274	59	355	0.9717	good target
406	59.34	166.32	0.04	0.044	0.04690	13	359	0.9927	small target on surface
407	43.97	187.28	0.37	0.134	1.35985	76	19	0.9463	medium sized target, good fit
408	45.61	198.90	0.06	0.064	0.14946	43	30	0.9259	small targ on surface
409	46.76	202.11	0.47	0.158	2.24732	78	355	0.9911	good target
410	33.45	199.71	0.22	0.125	1.11870	68	17	0.9650	medium sized target, god fit
411	37.58	171.35	1.81	0.156	2.16551	7	25	0.9500	fairly deep, low probability fit
412	15.73	168.13	0.34	0.202	4.67824	78	10	0.9954	excellent target, shallow
413	5.87	178.48	0.11	0.080	0.29446	7	21	0.9679	small target, shallow
414	4.57	184.27	0.58	0.140	1.57309	59	25	0.9861	good target, shallow
415	-1.65	192.72	0.67	0.158	2.23003	56	15	0.9867	excellent target
416	-12.24	185.47	0.04	0.050	0.07244	24	17	0.9590	small targ on surface
417	-16.61	181.81	0.06	0.060	0.12596	7	17	0.9947	small target, on surface
418	-17.37	172.17	0.71	0.183	3.51815	91	343	0.8926	surface clutter 1m NE and 2m SW
419	-9.62	169.61	0.95	0.163	2.47834	55	1	0.9864	good target
420	-39.08	194.97	0.08	0.069	0.18965	71	97	0.9220	small target near surface, clutter N & E
421	-46.79	201.39	0.66	0.172	2.91476	85	61	0.9667	good target
422	-43.66	188.57	0.36	0.144	1.71200	49	358	0.9825	good target with clutter target 1.5m SE
423	-49.32	189.72	0.15	0.150	1.94254	6	297	0.9401	good target, very shallow
424	-56.32	188.87	3.43	0.305	16.25668	2	152	0.9360	imposible signal, big & deep, must dig
425	-51.46	179.34	0.68	0.159	2.29475	72	354	0.9880	excellent target
426	-58.14	172.29	1.03	0.194	4.13660	105	153	0.9403	good target with clutter target 1.5m S
427	-77.79	173.94	0.61	0.237	7.60811	91	358	0.9592	large target, nose down & shallow
428	-82.69	162.60	0.90	0.156	2.14921	103	284	0.9787	good target, nose down
429	-96.59	185.00	0.96	0.161	2.36676	75	314	0.9600	good target

Table 5. Continued

Target ID	Local X (m)	Local Y (m)	Depth (m)	Size (m)	Moment	Inclin.	Azim.	Fit Quality	Analyst Comments
430	-95.05	177.36	4.06	0.200	4.53709	105	182	0.7877	low probability fit, very deep with tailfins 2m N
431	-113.46	193.70	0.57	0.057	0.10308	11	324	0.9737	small target at 0.6m
432	-91.57	202.33	0.74	0.164	2.53689	43	344	0.9909	good target
433	-137.79	181.75	1.19	0.091	0.42602	13	89	0.9032	medium target, poor fit, inverted sig
434	-149.38	184.45	0.41	0.197	4.33168	78	340	0.9884	good target, very shallow
435	-171.82	188.76	0.06	0.066	0.16061	1	356	0.9764	small target on surface
436	-187.29	185.30	2.74	0.263	10.31927	-2	110	0.9448	very deep, medium fit, inverted signature
437	-187.62	235.88	0.68	0.091	0.43231	-10	15	0.9103	small target medium deep
438	-172.81	232.83	0.42	0.217	5.85140	98	175	0.9861	good target
439	-165.47	238.01	0.07	0.116	0.89810	42	21	0.9284	two shallow targets 0.5m apart
440	-171.21	209.28	0.46	0.154	2.07983	58	31	0.9492	good target
441	-89.96	207.04	0.76	0.153	2.02484	90	81	0.9746	good target, nose down
442	-82.96	211.17	0.29	0.145	1.72147	73	12	0.9373	medium sized target, shallow
443	-45.30	238.83	0.35	0.181	3.39339	44	0	0.9924	good target, shallow
444	49.84	240.03	0.30	0.142	1.63006	113	113	0.9847	good target
445	59.59	234.16	0.51	0.146	1.77465	60	8	0.9930	excellent target
446	80.89	224.89	0.75	0.153	2.04796	82	300	0.9823	excellent target
447	119.92	222.34	0.70	0.159	2.28271	106	222	0.9866	excellent target
448	165.91	212.45	0.01	0.072	0.21184	43	352	0.8849	surface trash
449	204.79	235.47	0.03	0.090	0.42212	14	3	0.9539	small target on surface
450	246.13	269.83	0.00	0.089	0.40189	71	22	0.8624	surface trash
451	238.33	304.65	0.07	0.091	0.42864	3	26	0.9867	small target near surface
452	203.83	280.24	0.40	0.175	3.04765	92	177	0.9813	good target
453	94.28	258.09	0.52	0.181	3.37451	83	302	0.9658	good target, tail fins? on surface 1m SW
454	102.39	277.36	0.41	0.174	2.99827	71	4	0.9957	good target
455	94.52	287.57	1.01	0.179	3.28195	78	0	0.9790	good target
456	-36.18	252.16	0.50	0.137	1.47260	66	9	0.9772	good target
457	-21.98	257.97	0.86	0.152	2.01316	104	137	0.9502	good target with surface clutter 1m NE
458	-20.47	271.43	0.55	0.145	1.74043	72	338	0.9807	good target
459	-14.89	288.80	0.44	0.161	2.39997	92	173	0.9817	good target
460	-63.42	252.47	3.49	0.340	22.37392	1	253	0.9089	very big, very deep, inverted dipole, should dig
461	-69.12	285.87	2.46	0.253	9.19375	5	305	0.9133	big and deep, medium fit
462	-56.35	292.07	0.15	0.158	2.25842	36	46	0.9731	good target, very shallow

Table 5. Continued

Target ID	Local X (m)	Local Y (m)	Depth (m)	Size (m)	Moment	Inclin.	Azim.	Fit	Analyst Comments
463	-97.92	249.92	0.74	0.163	2.46927	87	280	0.9805	good target
464	-108.12	256.34	0.87	0.156	2.15695	65	356	0.9812	good target, surface clutter 1m SE
465	-137.59	249.65	0.43	0.060	0.12131	-6	25	0.8923	small target at half a meter
466	-176.67	284.75	0.82	0.075	0.24141	2	18	0.9017	small target deep, poor fit
467	-231.57	272.22	1.90	0.165	2.58109	19	108	0.9398	diffuse inverted signal, medium fit, deep, dig
468	-164.99	197.71	0.02	0.052	0.08195	-3	35	0.9251	small target on the surface
469	-170.38	281.78	3.01	0.184	3.56654	27	50	0.7514	large target very deep weak fit
470	-136.43	190.88	0.07	0.047	0.05844	16	47	0.9752	small target near surface
471	-134.75	206.99	0.00	0.051	0.07331	-1	345	0.9752	small target on surface
472	-60.82	153.34	0.08	0.057	0.10508	25	350	0.9773	small target, near surface
473	-24.26	212.57	1.12	0.123	1.05141	8	341	0.8981	diffuse target, medium fit, projectile?
474	50.35	147.45	0.04	0.062	0.13476	3	2	0.9813	small target on surface, clutter?
475	51.65	155.37	0.07	0.048	0.06321	22	21	0.9691	small target near surface
476	29.31	219.15	1.34	0.098	0.52896	16	38	0.7758	small target, very deep, weak fit
477	29.31	219.15	1.34	0.098	0.52896	16	38	0.7758	small target near the surface
478	72.16	221.17	0.00	0.050	0.07307	7	355	0.9213	small target on surface
479	102.31	205.71	0.01	0.059	0.11932	17	4	0.9822	small target on the surface
480	106.27	288.38	0.13	0.058	0.11082	23	26	0.9508	small target, near surface
481	139.98	305.96	0.17	0.065	0.15854	1	0	0.9454	small target near the surface
482	139.98	305.96	0.17	0.065	0.15854	1	0	0.9454	small target near the surface
483	164.52	224.87	0.06	0.050	0.06962	12	21	0.9732	small target on the surface
484	205.41	242.91	0.09	0.063	0.14524	13	7	0.9849	small target near the surface, won't fit
485	235.67	279.68	0.06	0.055	0.09427	35	358	0.8730	small target on surface, second target 1m SW

Table 6. Target Analysis of the EM Survey of the North Side of BBR I.

Target ID	Local X (m)	Local Y (m)	Depth (m)	Ferrous Size (m)	Non-Ferrous Size (m)	Fit Quality	Analyst Comments
1	262.88	13.50	0.00	0.021	0.019	0.1797	mag targ 1, use mag
2	249.07	14.06	0.73	0.050	0.080	0.4956	no mag targ. use this
3	242.94	21.11	0.00	0.013	0.010	0.1452	mag targ 3, use mag
4	241.57	23.20	0.00	0.015	0.012	0.3736	no mag target, use EM
5	180.70	7.46	0.39	0.093	0.227	0.9830	mag targ 8, use mag
6	170.32	12.47	0.19	0.138	0.412	0.9624	mag targ 9, use mag
7	158.24	15.73	0.18	0.114	0.312	0.8033	mag targ 14, use mag
8	144.33	9.41	0.00	0.035	0.043	0.8078	mag targ 15, use mag
9	135.76	5.57	0.36	0.199	0.689	0.9693	mag targ 16, use mag
10	127.02	10.63	0.89	0.117	0.322	0.8365	mag targ 24, use mag
11	124.98	8.26	0.00	0.038	0.049	0.9187	mag targ 25, use mag
12	101.82	8.14	0.08	0.073	0.152	0.9130	mag targ 29, use mag
13	110.10	2.47	0.00	0.022	0.019	0.5921	not in mag, 20mm on surface, left track on road
14	95.60	4.01	0.00	0.021	0.018	0.3763	not in mag, 20mm in right road track
15	95.48	15.82	0.00	0.078	0.171	0.9558	mag targ 30, use mag
16	83.19	11.62	0.14	0.088	0.207	0.9081	mag targ 40, use mag
17	74.69	1.50	0.00	0.032	0.036	0.9196	mag targ 41, use mag
18	69.45	8.21	0.00	0.021	0.018	0.4869	mag targ 45, use mag
19	60.33	8.91	0.00	0.024	0.022	0.8225	mag targ 46, use mag
20	60.34	1.72	0.19	0.082	0.187	0.9643	mag targ 43, partial sig. use mag
21	54.10	8.74	0.00	0.021	0.018	0.6296	no mag targ, possible 20mm on surface, use EM
22	52.66	12.84	0.00	0.033	0.039	0.8544	mag targ 65, use mag
23	49.08	13.84	0.52	0.091	0.220	0.8426	mag targ 64, use mag
24	46.80	8.69	0.00	0.042	0.060	0.8790	mag targ 66, use mag
25	42.50	5.73	0.59	0.070	0.144	0.7593	mag targ 67, use mag
26	35.61	7.68	0.00	0.051	0.083	0.8907	mag targ 69, use mag
27	35.13	0.08	0.00	0.047	0.072	0.9639	mag targ 68, use mag
28	26.19	8.72	0.11	0.075	0.161	0.8694	mag targ 76, use mag
29	22.12	4.10	0.63	0.230	0.832	0.9470	mag targ 74, use mag
30	21.02	7.69	0.00	0.042	0.060	0.9273	mag targ 75, use mag
31	16.53	13.36	0.01	0.050	0.080	0.6692	mag targ 88, use mag
32	11.88	14.74	0.40	0.128	0.369	0.9313	mag targ 102, use mag
33	15.46	4.36	0.80	0.167	0.542	0.8505	mag targ 89, use mag

Table 6. Continued

Target ID	Local X (m)	Local Y (m)	Depth (m)	Ferrous Size (m)	Non-Ferrous Size (m)	Fit Quality	Analyst Comments
34	12.50	0.36	0.37	0.123	0.350	0.9747	mag targ 90, use mag
35	8.05	6.41	0.32	0.111	0.298	0.9580	missed target in mag, use EM analysis
36	1.94	12.87	0.38	0.103	0.267	0.9187	mag targ 96, use mag
37	1.67	6.51	1.96	0.365	1.468	0.8482	mag targ 95, use mag
38	1.66	4.33	0.43	0.079	0.176	0.4932	not in mag, use EM analysis
39	-0.54	2.21	0.18	0.076	0.165	0.9077	mag targ 93, use mag
40	-1.54	6.78	1.59	0.267	1.000	0.6014	not in mag, use EM analysis
41	-7.70	-1.48	1.00	0.154	0.482	0.9330	mag targ 92, use mag
42	4.72	-0.16	0.17	0.100	0.254	0.9187	mag targ 91, use mag
43	-6.67	8.44	2.18	0.562	2.411	0.5848	mag targ 97, is really two targets
44	-10.07	12.26	0.59	0.096	0.240	0.8437	mag tart 99, use EM fit
45	-14.00	4.32	0.21	0.069	0.140	0.7619	not fit in mag, use EM analysis
46	-17.92	8.74	1.24	0.363	1.460	0.7122	mag targ 128, use mag, clutter everywhere
47	-15.94	0.87	0.75	0.121	0.342	0.8705	mag target 129, use mag
48	-18.86	0.15	0.47	0.103	0.267	0.9717	mag targ 130, use mag
49	-24.09	4.62	0.15	0.078	0.172	0.9141	mag targ 131, use mag
50	-28.93	4.05	0.67	0.321	1.259	0.8611	mag targ 132, use mag
51	-29.26	7.77	0.67	0.321	1.260	0.9469	mag targ 133, use mag
52	-31.81	9.59	0.45	0.087	0.205	0.9357	mag targ 134, use mag
53	-40.39	5.96	0.00	0.052	0.086	0.9566	mag targ 158, use mag
54	-55.09	3.60	0.51	0.112	0.305	0.9679	mag targ 163, use mag
55	-56.67	10.05	0.89	0.122	0.345	0.9398	mag targ 164, use mag
56	-71.18	1.79	0.00	0.041	0.058	0.8801	mag targ 166, use EM analysis
57	-88.17	-1.70	0.26	0.061	0.114	0.9076	not picked in mag, use EM
58	-88.96	3.62	0.87	0.132	0.388	0.9466	mag targ 190, use EM analysis
59	-93.84	9.96	1.16	0.183	0.614	0.9260	mag targ 191, use mag
60	-99.24	5.83	0.37	0.121	0.340	0.9559	mag targ 192, use mag
61	-103.03	5.80	1.30	0.166	0.539	0.7446	mag targ 193, use mag
62	-102.49	7.96	4.35	1.772	8.161	0.3455	mag targ 194, use mag
63	-124.98	7.30	0.00	0.056	0.097	0.9612	mag targ 198, use mag
64	-135.37	-0.14	0.00	0.021	0.018	0.5957	not in mag, 20mm, use EM analysis
65	-150.44	-3.02	0.00	0.023	0.020	0.7891	mag targ 207, use mag
66	-146.80	3.85	0.00	0.016	0.013	0.2541	not in mag, 20mm? use EM

Table 6. Continued

Target ID	Local X (m)	Local Y (m)	Depth (m)	Ferrous Size (m)	Non-Ferrous Size (m)	Fit Quality	Analyst Comments
67	-160.40	1.63	0.09	0.036	0.044	0.5239	mag targ 206, use mag
68	-166.40	4.44	0.00	0.027	0.028	0.8323	not in mag, use EM analysis
69	-176.54	-3.89	0.00	0.023	0.020	0.6292	mag targ 208, use mag
70	238.68	304.66	0.00	0.080	0.179	0.8848	mag targ 451
71	246.40	304.40	0.00	0.034	0.041	0.3307	not in mag, small likely on surface
72	240.50	316.77	0.00	0.064	0.123	0.8968	not in mag, small on surface, may be a cluster
73	235.44	279.53	0.03	0.092	0.225	0.8837	mag target 485, small, near surface
74	226.48	285.64	0.14	0.088	0.209	0.9520	not in mag, is reasonable target
75	203.74	280.18	0.08	0.091	0.221	0.9063	mag targ 452
76	140.24	306.66	0.00	0.039	0.052	0.3530	same as mag targ 481 and 482, 2 targs in EM
77	106.59	288.43	0.00	0.057	0.101	0.9302	mag targ 480
78	102.68	277.32	0.16	0.109	0.289	0.9743	mag targ 454
79	94.73	287.49	0.92	0.113	0.307	0.3990	mag targ455, may be two targs
80	5.23	276.57	0.00	0.022	0.019	0.3543	
81	0.20	279.44	0.00	0.032	0.037	0.6268	not in mag, surface target
82	-15.05	288.74	0.00	0.094	0.229	0.9586	mag target 459
83	-20.40	271.53	0.54	0.089	0.211	0.6389	mag target 458
84	-56.50	292.14	0.33	0.195	0.668	0.9058	mag targ 462
85	-50.72	277.73	0.00	0.041	0.055	0.6052	not in mag, is likely 2 targs on surface
86	-46.06	275.83	0.07	0.118	0.329	0.9738	not in mag likely is 2 targs
87	-107.01	254.65	0.34	0.078	0.170	0.5956	mag targ 464
88	-92.65	296.25	0.00	0.038	0.049	0.6931	not in mag, surface scrap
89	-96.54	265.87	0.00	0.027	0.027	0.6525	not in mag, surface scrap
90	-97.97	249.82	0.54	0.090	0.214	0.9521	mag targ 463
91	-240.04	290.69	1.42	0.121	0.340	0.2774	mag sees nothing, EM says big and deep, dig this
92	-232.50	218.70	0.28	0.043	0.061	0.7643	not in mag picks
93	-172.78	232.97	0.26	0.164	0.526	0.9557	mag targ 438
94	-165.32	237.98	0.00	0.103	0.265	0.8944	mag targ 439
95	-150.78	233.68	0.00	0.027	0.027	0.4299	not a mag pick
96	-45.61	239.02	0.51	0.247	0.912	0.9105	mag targ 443
97	-36.13	252.09	0.16	0.086	0.199	0.9017	mag targ 456
98	-21.99	258.13	0.66	0.106	0.279	0.8924	mag 457
99	-171.19	209.18	0.52	0.120	0.338	0.7781	mag targ 440

Table 6. Continued

Target ID	Local X (m)	Local Y (m)	Depth (m)	Ferrous Size (m)	Non-Ferrous Size (m)	Fit Quality	Analyst Comments
100	-165.99	206.39	0.00	0.037	0.046	0.8037	not in mag, surface scrap
101	-165.23	197.94	0.00	0.050	0.081	0.9161	mag targ 468
102	-134.90	206.92	0.00	0.031	0.035	0.6198	mag targ 471
103	-91.78	202.32	0.41	0.074	0.155	0.6143	mag targ 432
104	-89.91	207.23	0.54	0.087	0.205	0.6517	mag targ 441
105	-82.85	211.12	0.08	0.101	0.260	0.9543	mag targ 442
106	-46.88	201.42	0.27	0.100	0.256	0.9745	mag targ 421
107	30.27	250.03	0.00	0.044	0.063	0.8588	not in mag, small surface clutter
108	49.93	240.08	0.00	0.075	0.160	0.9204	mag targ 444
109	59.69	234.40	0.51	0.107	0.284	0.9299	mag targ 445
110	80.85	225.03	0.64	0.120	0.337	0.9384	mag targ 446
111	94.35	258.25	0.39	0.123	0.348	0.8100	mag targ 453
112	120.08	222.62	0.60	0.125	0.356	0.9563	mag targ 447
113	106.08	220.93	0.00	0.029	0.031	0.7908	not in mag, surface clutter
114	-201.45	159.34	0.56	0.133	0.392	0.9840	mag targ 369
115	-171.82	188.86	0.26	0.098	0.247	0.8107	mag targ 436
116	-149.47	184.42	0.22	0.120	0.337	0.9537	mag targ 434
117	-153.65	185.19	0.03	0.069	0.141	0.9122	not in mag, surface clutter
118	-136.42	190.76	0.00	0.024	0.023	0.8716	mag targ 470
119	-116.19	167.27	0.20	0.155	0.487	0.9070	not in mag, shallow target, medium sized
120	-96.55	185.00	0.85	0.122	0.344	0.9718	mag targ 429
121	-82.69	162.66	0.74	0.111	0.299	0.9426	mag targ 428
122	-77.73	173.87	0.24	0.149	0.463	0.9739	mag targ 427
123	-58.18	172.33	0.63	0.100	0.253	0.9288	mag targ 426
124	-51.43	179.24	0.65	0.106	0.277	0.8942	mag targ 425
125	-159.38	211.64	0.00	0.037	0.046	0.8203	not in mag, small targ on surface
126	-49.05	189.66	0.00	0.091	0.220	0.7976	mag targ 423
127	-43.67	188.44	0.08	0.089	0.212	0.9684	mag targ 422
128	-39.13	194.94	0.39	0.143	0.437	0.8560	mag targ 420
129	-12.24	185.55	0.13	0.068	0.136	0.8652	mag targ 416
130	-36.49	227.36	0.01	0.046	0.070	0.7710	not a mag pick, small targ, clutter
131	-199.25	167.20	0.00	0.037	0.048	0.8501	not in mag, small target near surface
132	-173.17	171.42	0.00	0.029	0.031	0.7691	not in mag cluster of clutter on surface

Table 6. Continued

Target ID	Local X (m)	Local Y (m)	Depth (m)	Ferrous Size (m)	Non-Ferrous Size (m)	Fit Quality	Analyst Comments
133	-156.47	156.62	0.01	0.076	0.163	0.9603	mag targ 370
134	32.60	294.44	0.00	0.036	0.045	0.8145	not a mag target, small on surface
135	25.55	303.32	0.00	0.019	0.016	0.1388	not a mag target, small on surface
136	73.80	290.20	0.00	0.025	0.024	0.3235	not a mag target, small on surface
137	264.01	297.90	0.00	0.049	0.076	0.8293	not in mag, surface clutter
138	245.90	269.58	0.00	0.070	0.145	0.8795	mag targ 450
139	255.34	262.60	0.00	0.037	0.048	0.8256	outside mag survey, surface clutter
140	228.39	275.99	0.00	0.031	0.035	0.3712	not a mag pick, small on surface
141	211.69	261.44	0.00	0.048	0.073	0.7630	not a mag pick, small on surface
142	209.50	263.28	0.00	0.037	0.048	0.7741	not a mag pick, small on surface
143	205.20	242.76	0.14	0.076	0.163	0.9442	mag target 484
144	193.68	250.83	0.11	0.073	0.154	0.7809	not a mag pick, small target
145	134.05	250.13	0.03	0.060	0.111	0.9249	not a mag pick, small target
146	80.37	240.14	0.00	0.037	0.047	0.9075	not a mag pick, surface clutter
147	102.78	205.23	0.00	0.031	0.033	0.4248	mag targ 479
148	164.50	224.95	0.00	0.052	0.086	0.9113	mag targ 483
149	166.21	212.40	0.00	0.068	0.135	0.8685	mag targ 448
150	168.08	215.77	0.00	0.063	0.120	0.9346	not a mag pick, small, near surface
151	165.81	216.83	0.00	0.048	0.075	0.8457	not a mag pick, maybe two targets, see 1m east
152	189.63	222.49	0.00	0.043	0.062	0.9350	not a mag pick, small near surface
153	191.95	226.29	0.18	0.077	0.166	0.9217	not a mag pick, medium target, shallow
154	204.51	235.41	0.00	0.075	0.160	0.9345	mag targ 449
155	93.69	186.79	0.00	0.049	0.077	0.8927	mag target 483
156	82.74	196.18	0.00	0.040	0.054	0.6494	not in mag survey
157	79.53	186.08	0.23	0.087	0.205	0.8547	mag targ 404
158	77.31	189.60	0.00	0.078	0.170	0.9510	mag targ 405
159	73.91	191.96	0.00	0.035	0.042	0.6881	not a mag pick
160	47.73	161.91	0.52	0.247	0.911	0.9529	mag target 392
161	15.77	168.09	0.49	0.239	0.872	0.9449	mag target 412
162	-16.64	181.80	0.00	0.041	0.055	0.8959	mag targ 417
163	-9.63	169.29	0.69	0.125	0.357	0.9604	mag target 419
164	-4.54	156.52	0.55	0.069	0.140	0.7516	mag target 379
165	-9.64	155.34	0.00	0.043	0.063	0.9124	mag target 378

Table 6. Continued

Target ID	Local X (m)	Local Y (m)	Depth (m)	Ferrous Size (m)	Non-Ferrous Size (m)	Fit Quality	Analyst Comments
166	-25.60	154.66	0.81	0.087	0.206	0.8706	mag target 377
167	-17.15	172.09	0.74	0.157	0.497	0.8929	mag target 418
168	-11.72	173.45	0.03	0.082	0.186	0.8688	not a mag pick, good target on surface
169	-18.99	169.65	0.00	0.047	0.071	0.8413	not a mag pick, small, on surface
170	-27.62	177.15	0.00	0.047	0.071	0.9145	not a mag pick, small, on surface
171	-60.71	153.33	0.03	0.060	0.111	0.8750	mag pick 472

Table 7. Target Analysis of the Magnetometry Survey for the South Side of BBR 1.

Target ID	Local X (m)	Local Y (m)	Depth (m)	Size (m)	Moment	Inclin.	Azim.	Fit Quality	Analyst Comments
1	230.59	-1.13	0.34	0.219	5.95864	10	90	0.8268	large target, inverted signal, also look 1m N
2	237.83	-34.51	0.85	0.142	1.62577	71	357	0.9855	excellent target nearly nose down
3	220.22	-8.39	0.00	0.042	0.04103	42	347	0.9462	scrap on surface
4	218.70	-8.41	0.00	0.037	0.02830	45	321	0.9772	scrap on surface
5	216.31	-39.65	0.79	0.157	2.22406	74	30	0.9923	excellent target
6	204.09	-24.26	0.10	0.054	0.08940	77	346	0.9361	small target near surface, scrap
7	173.84	-0.72	0.44	0.087	0.37863	78	90	0.8112	partial signature
8	161.90	-10.68	0.82	0.153	2.05889	49	356	0.9970	excellent target
9	168.28	-16.54	0.16	0.053	0.08362	3	304	0.9933	scrap slightly below surface
10	177.42	-44.02	0.52	0.168	2.68353	68	34	0.9896	good target, note second target 2m N
11	176.82	-40.52	1.61	0.171	2.86510	5	138	0.9348	inverted signal, big target near surface
12	175.76	-48.34	0.75	0.159	2.28571	74	346	0.9874	good target, target 10 is 2m N & scrap 1.5m NW
13	171.90	-45.95	0.15	0.046	0.05523	23	6	0.7941	2 or 3 pieces of clutter
14	147.99	-2.94	0.74	0.174	3.02218	46	17	0.9263	signal hiding in fenceline, check EM
15	130.62	-17.66	0.83	0.147	1.80009	69	341	0.9931	excellent target
16	96.46	-12.70	0.54	0.162	2.43780	65	35	0.9900	good target
17	86.59	-8.29	1.11	0.172	2.89937	37	12	0.9272	good target, in fenceline shadow, clutter NE & S
18	112.60	-32.28	1.01	0.128	1.18217	68	303	0.9831	good target, fairly deep
19	98.25	-36.76	0.26	0.122	1.02565	67	330	0.9892	good target, pretty shallow
20	89.38	-41.83	0.42	0.127	1.17285	49	355	0.9864	medium target, smaller target 1.5m SE & clutter E
21	90.51	-43.17	0.22	0.075	0.24335	48	341	0.9552	this item is paired up with target 20, 1.5m NE
22	94.23	-46.73	0.48	0.153	2.02466	89	357	0.9650	good target at half a meter
23	86.56	-51.98	0.45	0.153	2.03873	75	339	0.9778	good target
24	81.44	-43.92	0.37	0.148	1.85516	63	9	0.9840	good target shallow, scrap 2m NE
25	77.71	-47.79	0.01	0.046	0.05581	23	347	0.9463	scrap
26	69.67	-5.62	0.57	0.169	2.72901	62	15	0.9798	target in fence shadow, use EM analysis
27	68.77	-18.06	0.73	0.187	3.70364	86	29	0.9849	good target
28	70.23	-19.96	0.18	0.055	0.09345	22	14	0.9882	small target near surface
29	61.39	-33.04	0.56	0.183	3.49905	86	354	0.9904	good target, scrap 1m E
30	58.65	-28.55	0.64	0.170	2.78392	77	332	0.9866	excellent target
31	46.50	-16.76	0.80	0.235	7.41621	67	344	0.9907	large target with scrap 1m N and 1.5m S
32	47.05	-12.22	0.00	0.070	0.19784	34	354	0.7610	scrap on surface
33	44.03	-12.63	0.32	0.159	2.27819	86	63	0.9784	good target, note target 31 2m SSE

Table 7. Continued

Target ID	Local X (m)	Local Y (m)	Depth (m)	Size (m)	Moment	Inclin.	Azim.	Fit Quality	Analyst Comments
35	61.71	-47.83	0.85	0.165	2.57124	69	14	0.9719	good target, note target 34 to the N
36	70.25	-35.72	0.00	0.057	0.10779	28	360	0.8638	scrap on surface
37	42.46	-38.09	0.55	0.180	3.33373	81	358	0.9901	good target, note target 38 to the S
38	43.65	-40.50	0.89	0.170	2.82253	65	353	0.9809	good target, note target 37 to the N
39	36.92	-44.22	1.12	0.157	2.21097	83	102	0.9895	good target, note scrap 1 m W
40	34.55	-37.97	0.64	0.201	4.64417	73	23	0.9942	good target
41	32.34	-11.92	0.64	0.145	1.75538	82	7	0.9825	good target
42	30.22	-18.91	0.56	0.185	3.60718	72	51	0.9970	good target
43	25.87	-15.11	0.62	0.200	4.56680	64	336	0.9626	good target, scrap 1m SE
44	23.72	-17.73	0.69	0.196	4.30667	76	343	0.9832	good target
45	28.81	-27.70	0.44	0.229	6.87532	79	349	0.9910	good target
46	28.23	-30.35	0.93	0.232	7.08440	59	346	0.9870	good target, scrap 1m S
47	24.18	-33.56	0.66	0.172	2.90775	49	327	0.9903	good target
48	22.86	-30.73	0.33	0.095	0.49236	69	25	0.9787	medium target, is not a practice bomg
49	20.29	-36.63	0.46	0.188	3.79893	43	327	0.9913	good target, scrap 1.5m WSW
50	21.30	-40.40	0.83	0.136	1.43784	69	44	0.9815	good target
51	17.52	-40.49	0.52	0.188	3.78712	42	353	0.9296	good target, there is second target 1m W
52	15.75	-40.93	0.55	0.201	4.63936	50	355	0.9724	good target, target 51 is 1m E
53	12.97	-41.16	0.74	0.185	3.60517	76	294	0.8906	good target, medium fit
54	17.81	-29.54	0.37	0.170	2.79422	50	355	0.9896	good target
55	10.66	-29.15	0.38	0.133	1.34815	58	4	0.9440	good target, several pieces of scrap 1.5m S
56	18.38	-26.77	0.40	0.162	2.40151	81	98	0.9377	good target medium fit
57	17.30	-24.86	0.49	0.165	2.54729	66	18	0.9882	good target in a tight cluster of practice bombs
58	10.66	-24.53	0.05	0.062	0.13629	44	42	0.9864	small target near surface, scrap
59	16.54	-20.58	0.76	0.147	1.80055	78	329	0.9931	good target, scrap 00.7m SW
60	12.80	-17.92	0.91	0.153	2.02381	67	343	0.9824	good target, scrap 1m to NW
61	14.51	-12.03	0.92	0.162	2.44272	61	359	0.9895	good target
62	13.76	-7.73	0.90	0.189	3.86549	82	317	0.9596	god target in fence shadow
63	3.64	-13.01	0.50	0.182	3.45934	86	63	0.9424	good target
64	-1.26	-15.12	0.50	0.158	2.26169	55	5	0.9826	good target
65	4.51	-18.15	0.02	0.062	0.13569	18	23	0.9859	scrap on surface
66	1.85	-19.88	0.55	0.153	2.05511	84	41	0.9867	good target
67	-1.31	-20.20	0.26	0.123	1.04912	38	53	0.9897	medium target, shallow, scrap 0.5m S

Table 7. Continued

Target ID	Local X (m)	Local Y (m)	Depth (m)	Size (m)	Moment	Inclin.	Azim.	Fit Quality	Analyst Comments
68	-0.66	-30.08	0.28	0.124	1.09284	83	312	0.9788	medium target, shallow
69	-2.90	-31.62	1.01	0.239	7.78067	82	149	0.9890	good target, nose down
70	-2.27	-35.15	0.72	0.198	4.41760	50	337	0.9181	good target, 2 more targs 1m SW & SE
71	-3.24	-37.00	0.61	0.153	2.03479	65	228	0.9513	OK target, see targ 70
72	-0.77	-36.41	0.63	0.131	1.29185	71	130	0.9439	medium target near larger targets
73	5.84	-38.59	0.65	0.187	3.74673	53	40	0.9779	good target
74	7.36	-40.35	0.67	0.228	6.78069	55	124	0.9301	good target, see targets 73 & 75
75	8.06	-42.04	0.42	0.189	3.87839	67	6	0.9778	good target
76	2.41	-42.47	0.82	0.190	3.91796	39	8	0.9750	good target
77	-2.09	-42.53	0.54	0.183	3.48114	78	203	0.9791	good target
78	-5.17	-40.62	0.96	0.246	8.51797	73	221	0.8689	good target, deep
79	-7.99	-29.36	0.96	0.214	5.55481	60	301	0.9859	good target
80	-7.24	-26.94	0.72	0.186	3.69132	80	360	0.9518	good target, scrap to the S
81	-5.33	-22.12	0.85	0.178	3.20354	80	176	0.9604	good target, nose down
82	-7.90	-15.36	1.25	0.201	4.63039	51	5	0.9652	good target, deeper than average
83	-21.01	-13.73	0.37	0.203	4.79601	52	31	0.9838	good target, above and W
84	-30.35	-9.63	0.35	0.204	4.87457	72	321	0.9625	good target
85	-32.38	-15.30	0.69	0.166	2.62814	59	25	0.9919	good target
86	-30.38	-15.14	0.28	0.152	2.02103	79	318	0.9734	good target
87	-29.13	-16.00	0.43	0.134	1.35748	73	81	0.9610	medium target
88	-28.11	-17.93	0.58	0.144	1.70616	57	42	0.9647	medium target
89	-25.87	-23.43	0.37	0.196	4.26596	67	8	0.9886	good target
90	-15.78	-30.08	0.72	0.194	4.16721	87	119	0.9495	good target above and to the N
91	-13.60	-32.58	0.97	0.190	3.89187	55	26	0.9683	good target
92	-22.82	-37.33	0.42	0.132	1.32358	90	341	0.9581	medium target
93	-26.37	-35.82	0.47	0.169	2.77469	74	312	0.9911	good target
94	-29.56	-39.56	0.44	0.203	4.74759	64	351	0.9646	good target
95	-26.61	-43.22	0.48	0.174	3.00521	74	15	0.9892	good target, clutter to the N
96	-30.68	-42.86	0.74	0.233	7.23109	56	359	0.9708	good target, clutter1.5m W
97	-33.90	-25.38	0.76	0.170	2.81997	74	345	0.9869	good target
98	-39.28	-19.87	0.44	0.197	4.36802	72	1	0.9930	good target
99	-56.50	-12.61	0.44	0.160	2.34870	71	6	0.9858	good target
100	-54.21	-18.47	0.77	0.164	2.51778	56	9	0.9837	good taret

Table 7. Continued

Target ID	Local X (m)	Local Y (m)	Depth (m)	Size (m)	Moment	Inclin.	Azim.	Fit Quality	Analyst Comments
101	-54.46	-25.79	0.09	0.077	0.25815	36	10	0.9750	small target near the surface
102	-48.26	-17.18	0.05	0.060	0.12389	87	325	0.9501	clutter on the surface
103	-44.15	-30.40	0.05	0.066	0.16105	60	7	0.9134	clutter on the surface
104	-41.09	-38.79	0.03	0.053	0.08676	35	9	0.9836	clutter on the surface
105	-48.61	-37.79	0.00	0.045	0.05276	19	30	0.9555	clutter on the surfae
106	-51.72	-44.60	0.03	0.048	0.06487	30	12	0.9041	clutter on the surface
107	-46.40	-50.88	0.32	0.154	2.07060	48	14	0.9948	practice bomb
108	-65.84	-47.30	1.07	0.184	3.52924	88	88	0.9845	practice bomb, nose down
109	-74.48	-49.75	0.96	0.161	2.38574	62	24	0.9911	practice bomb
110	-60.64	-29.99	0.76	0.165	2.54635	63	32	0.9906	practice bomb, clutter 2m W
111	-70.79	-21.02	0.79	0.153	2.06111	61	11	0.9871	practice bomb
112	-82.42	-38.62	0.76	0.108	0.71100	48	49	0.9344	medium target, clutter to W
113	-88.06	-51.46	0.48	0.169	2.75428	85	288	0.9920	practice bomb
114	-96.27	-43.58	0.72	0.170	2.77701	80	253	0.9888	practice bomb
115	-104.42	-46.35	0.57	0.190	3.92056	69	282	0.9925	practice bomb
116	-115.54	-49.06	0.94	0.200	4.56414	79	19	0.9944	practice bomb
117	-111.60	-15.47	0.35	0.150	1.91694	76	3	0.9863	practice bomb, clutter 1m E
118	-123.61	-27.34	0.02	0.049	0.06810	38	11	0.9324	clutter on surface
119	-151.31	-21.03	0.23	0.074	0.23419	44	71	0.9667	small target at 1/4m
120	-157.13	-25.10	0.00	0.066	0.16656	37	10	0.9530	clutter on surface
121	-141.99	-37.54	0.02	0.046	0.05425	51	28	0.9672	clutter on surface
122	-123.87	-36.57	0.38	0.161	2.39192	72	359	0.9939	practice bomb, clutter 1m SW
123	-124.77	-44.92	0.58	0.141	1.60171	68	46	0.9923	medium target
124	-173.33	-33.98	0.06	0.056	0.09880	37	5	0.9798	clutter near surface
125	-227.23	-30.65	0.12	0.054	0.08837	2	28	0.9888	clutter near surface
126	-241.00	-72.78	0.13	0.069	0.18819	4	271	0.9918	small target near surface
127	-240.19	-86.23	0.42	0.158	2.26994	83	230	0.9833	practice bomb
128	-205.68	-68.28	0.69	0.162	2.41714	82	150	0.9801	practice bomb
129	-200.59	-93.27	0.56	0.159	2.27072	74	4	0.9921	practice bomb
130	-189.91	-94.66	0.47	0.181	3.36422	33	46	0.9875	practice bomb, clutter 1.5m SSW
131	-181.44	-95.38	0.41	0.175	3.06651	85	334	0.9871	practice bomb, clutter on three sides
132	-189.45	-87.92	0.39	0.156	2.14831	57	43	0.9950	practice bomb
133	-168.19	-95.58	0.04	0.052	0.08203	34	355	0.9938	clutter near surface

Table 7. Continued

Target ID	Local X (m)	Local Y (m)	Depth (m)	Size (m)	Moment	Inclin.	Azim.	Fit Quality	Analyst Comments
134	-164.64	-90.58	0.54	0.166	2.58969	49	25	0.9819	practice bomb
135	-151.49	-94.18	0.00	0.043	0.04469	32	359	0.8591	surface clutter
136	-143.39	-92.58	0.37	0.067	0.16748	30	338	0.9887	small target at 1/2 mater
137	-150.27	-85.28	0.42	0.145	1.72107	67	14	0.9889	medium sized target
138	-159.55	-67.55	0.92	0.178	3.20196	4	17	0.9867	practice bomb
139	-174.23	-62.02	0.44	0.201	4.63615	30	50	0.9883	practice bomb
140	-133.35	-83.85	0.63	0.175	3.07499	81	15	0.9891	practice bomb, clutter 2m SE
141	-129.36	-85.59	0.79	0.152	2.01002	66	2	0.9935	practice bomb, clutter 2m W
142	-121.03	-83.15	0.04	0.058	0.10977	27	19	0.9902	cluter near surface
143	-121.29	-69.99	0.45	0.162	2.42199	68	65	0.9893	practice bomb with clutter above
144	-116.60	-55.94	1.10	0.197	4.39000	43	8	0.9839	practice bomb, deep
145	-101.04	-62.07	0.50	0.155	2.12217	54	5	0.9890	practice bomb
146	-97.36	-85.12	0.71	0.141	1.58247	69	31	0.9905	practice bomb (small limit)
147	-80.65	-79.97	0.83	0.162	2.41107	71	19	0.9882	practice bomb, clutter E & NE
148	-74.50	-70.81	0.50	0.152	2.02012	71	3	0.9949	practice bomb
149	-65.48	-58.40	0.02	0.062	0.13379	0	39	0.9935	clutter on surface
150	-65.66	-66.78	0.38	0.174	3.02702	90	323	0.9908	practice bomb, nose down
151	-59.68	-79.06	0.63	0.146	1.78492	74	3	0.9889	practice bomb, clutter 2m NW
152	-57.35	-74.12	0.85	0.154	2.08529	65	39	0.9903	practice bomb
153	-48.11	-75.94	1.20	0.176	3.08542	68	22	0.9897	practice bomb, deep
154	-48.76	-64.55	1.14	0.179	3.26931	84	121	0.9865	practice bomb, nose down
155	-33.35	-66.82	0.59	0.158	2.22800	74	38	0.9864	practice bomb, with clutter 1.5m NE
156	-34.80	-63.55	0.58	0.156	2.16131	65	21	0.9943	practice bomb
157	-28.76	-61.89	0.85	0.216	5.76090	81	77	0.9782	practice bomb (near large size limit)
158	-37.65	-56.91	0.88	0.164	2.53277	39	341	0.9943	practice bomb
159	-26.12	-46.32	0.28	0.155	2.10899	81	307	0.9742	practice bomb, see other large targ 1m S
160	-26.15	-47.59	0.32	0.156	2.15008	78	352	0.9934	practice bomb, see targ 159 1m N
161	-18.07	-43.91	1.11	0.201	4.64660	58	15	0.9597	practice bomb, clutter above to N
162	-23.90	-52.96	0.73	0.203	4.80066	72	16	0.9477	practice bomb, clutter 0.5m E
163	-24.10	-59.21	0.54	0.158	2.23701	76	295	0.9801	practice bomb, see targ 164 at 1.5m S
164	-24.58	-60.86	0.55	0.138	1.51224	86	262	0.9424	lower limit for practice bomb
165	-25.25	-65.84	1.13	0.128	1.19695	71	72	0.8043	possible deep nose down targ, very low fit
166	-23.85	-69.78	0.58	0.186	3.67949	28	353	0.9849	practice bomb

Table 7. Continued

Target ID	Local X (m)	Local Y (m)	Depth (m)	Size (m)	Moment	Inclin.	Azim.	Fit Quality	Analyst Comments
167	-19.32	-69.55	1.07	0.140	1.56058	85	90	0.9798	
168	-10.59	-71.38	0.53	0.165	2.54038	75	14	0.9742	practice bomb, with clutter 1.5m W
169	-16.90	-58.89	0.52	0.163	2.47544	35	15	0.9431	practice bomb with clutter above
170	-11.11	-43.89	0.37	0.134	1.37205	53	354	0.9897	medium target, clutter to NE and bomb 1.5m SE
171	-9.79	-45.88	0.69	0.188	3.81534	87	26	0.9794	practice bomb
172	-0.87	-69.49	0.49	0.154	2.08991	61	346	0.9839	practice bomb .
173	2.94	-66.16	0.62	0.151	1.95579	70	40	0.9596	practice bomb with clutter 0.5m E
174	3.03	-63.33	0.66	0.129	1.21538	65	56	0.9894	small size limit for practice bomb
175	0.61	-63.85	0.00	0.063	0.14097	46	360	0.9283	scrap on the surface
176	-7.30	-63.33	0.98	0.187	3.70212	58	12	0.9283	practice bomb with clutter above and 1m E
177	-8.96	-54.32	1.04	0.171	2.85541	88	352	0.9776	practice bomb, surrounded by clutter
178	-4.32	-52.23	0.97	0.163	2.47155	72	105	0.9647	practice bomb
179	-2.73	-54.03	0.33	0.147	1.79683	79	163	0.9882	practice bomb
180	0.05	-54.63	0.23	0.100	0.56538	55	72	0.9635	small target, shallow
181	6.55	-57.24	0.38	0.148	1.83950	14	334	0.9708	practice bomb with clutter above
182	2.18	-58.12	0.72	0.193	4.12251	65	25	0.9709	practice bomb
183	7.11	-46.95	0.55	0.169	2.76813	71	28	0.9862	practice bomb, clutter 0.5m SW
184	10.10	-52.53	0.67	0.133	1.34287	81	72	0.9923	small size end of practice bomb
185	12.38	-53.50	0.39	0.100	0.57280	60	20	0.9748	medium sized target
186	11.23	-60.83	0.82	0.246	8.53157	87	174	0.8551	large for practice bomb, clutter 0.5m N, bomb 2m E
187	13.71	-60.94	0.73	0.224	6.42252	16	354	0.8266	practice bomb, clutter 1m N, bomb 2m W
188	16.34	-63.93	0.00	0.051	0.07527	35	357	0.9210	clutter on surface
189	21.38	-59.88	0.71	0.141	1.60210	73	26	0.9592	practice bomb
190	26.25	-63.51	0.51	0.205	4.91833	59	324	0.9853	practice bomb, clutter 1m S
191	26.24	-59.89	0.55	0.192	4.02280	49	353	0.9919	practice bomb
192	33.97	-63.03	0.05	0.055	0.09419	22	107	0.9885	clutter on surface, inverted signal
193	30.73	-53.22	0.00	0.049	0.06540	35	356	0.8918	clutter on surface
194	26.20	-52.86	0.61	0.159	2.28018	10	9	0.9887	parctice bomb, second target 1m S
195	26.13	-54.94	0.27	0.068	0.17723	74	132	0.9470	small target 1m south of 194
196	19.81	-50.37	0.49	0.216	5.71679	83	90	0.9356	practice bomb, southmost of a group of four
197	21.16	-49.20	0.52	0.187	3.73435	84	324	0.8738	practice bomb, 1m northeast of targ 196
198	21.59	-47.04	0.43	0.209	5.23299	86	329	0.9701	practice bomb, 2m N of targ 197
199	22.13	-45.25	0.73	0.225	6.48587	82	219	0.6801	practice bomb, 2m NNE of targ 198

Table 7. Continued

Target ID	Local X (m)	Local Y (m)	Depth (m)	Size (m)	Moment	Inclin.	Azim.	Fit Quality	Analyst Comments
200	28.33	-49.44	0.91	0.165	2.55217	51	349	0.9892	practice bomb, good target
201	39.85	-54.24	0.38	0.195	4.20009	53	320	0.9966	practice bomb, good target
202	46.17	-67.77	1.09	0.198	4.42525	77	59	0.9743	practice bomb
203	56.12	-70.99	0.41	0.177	3.18043	76	334	0.9911	practice bomb
204	9.62	-68.66	0.42	0.181	3.39166	47	339	0.9536	practice bomb
205	11.14	-69.99	0.60	0.141	1.59235	67	20	0.9334	practice bomb with bombs both E & W
206	12.68	-68.46	0.75	0.167	2.65078	87	233	0.9641	practice bomb
207	16.55	-69.68	0.42	0.128	1.18187	86	229	0.2937	practice bomb, larry stopped on top giving poor fit
208	20.38	-69.71	0.67	0.200	4.59298	53	332	0.9759	practice bomb
209	30.14	-70.69	0.03	0.063	0.14255	13	7	0.9969	small target on the surface
210	64.87	-56.27	0.82	0.159	2.31174	89	301	0.9788	practice bomb, pretty deep, nose down
211	69.24	-60.01	0.05	0.057	0.10765	43	2	0.9976	small target, near the surface
212	74.40	-56.04	0.01	0.050	0.07042	43	23	0.9339	small target, at the surface
213	71.35	-50.46	0.08	0.048	0.06371	51	128	0.9205	small target, near the surface
214	81.90	-55.28	0.13	0.052	0.07815	90	16	0.8613	small target, shallow
215	120.82	-70.01	0.90	0.188	3.81554	83	170	0.9813	practice bomb
216	130.90	-63.41	0.51	0.165	2.54355	76	340	0.9881	practice bomb
217	163.08	-57.53	0.47	0.159	2.30515	45	27	0.9945	practice bomb
218	219.52	-62.61	0.61	0.169	2.75413	69	7	0.9949	practice bomb, good target
219	243.55	-60.50	1.03	0.167	2.67280	61	360	0.9926	practice bomb, fairly deep

Table 8. Target Analysis of the Magnetometry Survey for BBR Target 2.

Target ID	Local X (m)	Local Y (m)	Depth (m)	Size (m)	Moment	Inclin.	Azim.	Fit Quality	Analyst Comments
1	19.81	162.95	0.17	0.05	0.06867	45	354	0.9885	small target, shallow, good fit
2	26.70	160.92	0.17	0.05	0.05330	2	352	0.9946	small target, shallow, good fit
3	25.32	169.09	0.06	0.04	0.03072	5	59	0.9934	small target on surface
4	15.12	177.76	0.22	0.04	0.03042	7	356	0.9164	small target at 1/4m
5	18.22	183.38	0.08	0.03	0.01944	67	352	0.9572	very small target near surface
6	32.11	181.60	0.09	0.05	0.07886	9	335	0.9962	small target near surface
7	37.14	180.68	0.27	0.04	0.04224	55	42	0.9874	very small target at 1/4m
8	42.92	173.45	0.35	0.05	0.07048	67	344	0.9186	small target at 1 ft
9	52.96	169.66	0.06	0.06	0.09975	8	326	0.9824	small target on surface
10	43.93	165.07	0.05	0.03	0.01992	36	329	0.9159	very small target on surface
11	45.55	165.27	0.08	0.04	0.02817	13	0	0.7864	small target on surface with clutter 0.5m to SW
12	63.79	180.50	0.10	0.04	0.03439	21	341	0.9738	very small target
13	70.04	180.66	0.06	0.04	0.02456	-2	337	0.9872	very small target
14	70.24	181.78	0.16	0.04	0.02936	41	357	0.9239	very small target
15	61.24	179.47	0.10	0.04	1.82241	13	320	0.9864	good target, very shallow, clutter above to NE
16	62.26	175.46	0.13	0.04	0.65756	37	348	0.9099	medium target, very shallow
17	62.48	173.48	0.08	0.04	0.06186	38	304	0.9584	small target near the surface
18	66.15	158.41	0.39	0.04	1.00257	15	314	0.9775	medium sized target, good fit
19	71.61	160.85	0.06	0.04	0.09904	19	347	0.9803	small target near the surface
20	73.02	156.14	0.26	0.04	0.11705	37	2	0.9736	small target at 1/4m
21	84.28	154.04	0.06	0.04	0.36087	21	336	0.9466	medium target, near surface
22	87.21	157.76	0.06	0.04	0.07323	9	339	0.9651	small target on surface
23	83.85	159.22	0.48	0.04	3.30383	43	320	0.9909	practice bomb?
24	84.35	164.97	0.04	0.04	0.18445	6	345	0.9116	small targ on surface, with clutter to S & E
25	88.36	164.70	0.33	0.04	6.07913	22	320	0.9949	practice bomb? with clutter to W, N & E
26	81.88	182.79	0.10	0.04	0.18375	13	314	0.9842	small target near surface
27	90.64	183.93	0.05	0.04	0.91500	-9	316	0.9766	large target on surface
28	90.84	179.90	0.66	0.04	10.06395	4	0	0.9867	large targ. (M38?) clutter to S & SE
29	96.94	183.30	0.37	0.04	1.59104	19	355	0.9378	good target
30	98.70	179.33	0.99	0.04	15.86224	11	358	0.6157	extended target from this point to 2m W?
31	106.28	184.06	0.42	0.04	15.95471	11	311	0.9761	large target at the W end of overlapping targ.
32	109.52	179.75	0.53	0.04	8.49009	12	355	0.9733	large target, pretty shallow, tail fins on E edge
33	110.78	176.66	0.39	0.04	4.73983	-8	359	0.9827	good target with large clutter target 1m W

Table 8. Continued.

Target ID	Local X (m)	Local Y (m)	Depth (m)	Size (m)	Moment	Inclin.	Azim.	Fit Quality	Analyst Comments
34	101.83	171.27	0.67	0.22	6.12251	-1	0	0.9898	good target
35	105.34	169.39	0.06	0.10	0.58430	7	300	0.9883	medium target on surface
36	98.18	169.46	0.28	0.13	1.21612	50	6	0.9733	medium target
37	93.87	168.59	0.99	0.24	7.66689	8	354	0.9822	large target, fairly deep, good fit, clutter 1.5m W
38	96.15	160.80	0.07	0.09	0.39365	7	351	0.9657	small target on surface
39	96.17	157.76	0.91	0.24	8.22429	-56	335	0.5254	large target with fit problem
40	107.93	158.40	0.31	0.22	6.39413	17	306	0.9872	large target at 1 ft
41	106.02	156.51	1.21	0.31	16.55619	2	6	0.7524	this is likely trash/clutter which extends S
42	109.81	161.75	0.00	0.18	3.41351	-35	355	0.5629	several large pieces of junk extending N
43	106.45	165.57	0.92	0.22	6.28864	13	358	0.8309	a lot of clutter all around
44	111.85	165.96	0.07	0.10	0.50594	-5	300	0.9466	medium target on surface
45	107.62	170.18	0.09	0.10	0.56814	0	317	0.9329	stuff on surface, also look 1m NE
46	116.05	172.30	0.43	0.30	15.58955	36	311	0.9369	very large target, shallow, clutter above to NW
47	118.01	169.78	0.25	0.16	2.54022	74	275	0.6969	poor fit, large stuff also 1m W
48	116.46	166.11	0.00	0.07	0.19103	53	6	0.6027	several pieces of clutter, also look N 1m
49	119.17	177.76	0.09	0.11	0.74506	-2	246	0.9835	medium target on surface, inverted signal
50	123.17	170.79	0.11	0.14	1.43152	10	329	0.9290	likely junk on surface
51	127.32	160.69	0.83	0.22	6.27491	20	268	0.9388	inverted signal, clutter to S
52	132.40	154.43	0.31	0.14	1.46217	18	191	0.9672	strong target, with inverted signal
53	139.02	164.83	0.11	0.17	2.93474	-2	238	0.9592	strong target on surface with inverted signal
54	129.90	161.45	0.02	0.07	0.18815	2	1	0.9604	surface clutter
55	130.21	175.25	0.08	0.08	0.25807	2	271	0.8556	inverted signal, surface item
56	134.69	179.72	0.00	0.07	0.17971	0	7	0.9187	small target on surface
57	131.55	186.26	0.07	0.08	0.31007	2	247	0.9846	inverted signal, small target on surface
58	141.19	172.44	0.03	0.06	0.14489	0	286	0.8356	inverted signal, small targ on surface
59	141.27	169.93	0.18	0.12	0.95979	4	245	0.9962	inverted signal, medium target, shallow
60	139.45	169.81	0.07	0.09	0.41970	1	223	0.9786	inverted signal, surface target
61	142.87	167.31	0.03	0.08	0.32387	-12	246	0.9227	inverted signal, likely 2 targets
62	149.43	176.44	0.24	0.09	0.45234	1	243	0.9331	inverted signal, second target 1m N
63	151.78	162.56	0.04	0.06	0.14749	-3	251	0.9918	small targ on surface, inverted signal
64	126.01	176.63	0.68	0.14	1.50282	5	184	0.9311	medium target, inverted fuzzy signal
65	131.90	181.60	0.00	0.07	0.16402	-10	261	0.8512	surface target, inverted signal
66	159.18	164.08	0.06	0.07	0.21864	2	242	0.9943	surface target, inverted signal

Table 8. Continued.

Target ID	Local X (m)	Local Y (m)	Depth (m)	Size (m)	Moment	Inclin.	Azim.	Fit Quality	Analyst Comments
67	160.27	159.49	0.03	0.06	0.14657	24	260	0.9925	surface target, inverted signal
68	189.07	170.42	0.13	0.13	1.25276	6	204	0.9701	medium target on surface, inverted signal
69	180.60	178.70	0.07	0.04	0.03515	-3	202	0.9687	surface target, inverted signal
70	252.94	171.70	0.49	0.20	4.75843	88	197	0.9855	good target, good fit, nose down
71	249.97	177.10	0.17	0.07	0.16311	58	314	0.9774	small target, near surface
72	278.18	183.20	0.52	0.21	5.21065	78	298	0.9837	good target, good fit
73	290.74	174.33	0.21	0.17	2.74108	87	41	0.9653	good target, 2 clutter targs 1m S
74	314.26	159.01	0.00	0.12	0.97920	66	313	0.8026	medium target on surface
75	352.65	170.48	0.06	0.07	0.22490	54	162	0.9465	surface target
76	353.26	161.14	0.07	0.12	1.06772	-49	72	0.1137	trash pile extending 3m north
77	215.28	181.09	0.68	0.16	2.49336	68	174	0.9011	large target poor fit, clutter above 1m N
78	218.31	185.72	0.62	0.22	6.17768	84	256	0.8891	large target, poor fit, clutter above 1m S
79	211.99	197.43	0.41	0.17	2.70776	41	175	0.9913	solid target, inverted signal
80	210.33	199.64	0.44	0.16	2.17112	55	184	0.9727	solid target, inverted signal
81	210.96	190.05	0.08	0.03	0.02219	85	18	0.9184	small target on the surface
82	210.90	184.73	0.07	0.03	0.02207	63	10	0.9574	small target, near surface
83	207.93	188.06	0.24	0.06	0.10210	14	3	0.6314	poor fit, likely near the surface
84	174.97	188.67	0.04	0.04	0.04352	4	182	0.8091	surface target, inverted signal
85	169.49	187.96	0.43	0.21	5.44329	25	191	0.9956	large target, inverted signal
86	164.83	192.11	0.62	0.23	7.20437	9	195	0.9569	large target, inverted signal
87	171.10	205.77	0.12	0.08	0.26713	2	193	0.8645	small target near surface, inverted signal
88	171.10	208.28	0.08	0.10	0.65084	-5	165	0.9824	medium target on surface, inverted signal
89	153.82	210.07	0.02	0.10	0.60469	-3	154	0.9908	medium target on surface, inverted signal
90	148.23	211.31	0.40	0.24	8.18352	13	158	0.9756	large target, inverted signal
91	138.11	197.34	0.07	0.11	0.81085	3	216	0.9339	surface target, inverted signal
92	138.77	207.84	0.06	0.06	0.10778	7	142	0.9496	surface target
93	134.57	204.32	0.07	0.07	0.20353	8	142	0.9909	surface target
94	126.58	198.59	0.15	0.08	0.24209	-10	161	0.8999	small target, inverted signal
95	129.74	185.27	0.08	0.06	0.12074	-1	231	0.9270	small surface target, inverted signal
96	127.65	187.94	0.27	0.09	0.45861	-3	241	0.9631	small target, inverted signal
97	126.07	189.57	0.12	0.07	0.21030	0	239	0.9074	near surface targ, inverted signal
98	124.98	192.60	0.07	0.12	1.04895	12	210	0.9938	surface target, inverted signal
99	122.45	195.73	0.00	0.04	0.04287	-3	14	0.0076	pile of clutter extendes S 2m

Table 8. Continued.

Target ID	Local X (m)	Local Y (m)	Depth (m)	Size (m)	Moment	Inclin.	Azim.	Fit Quality	Analyst Comments
100	120.74	197.05	0.12	0.10	0.64227	-7	196	0.9748	surface target, inverted signal
101	120.55	198.63	0.10	0.09	0.39491	-9	234	0.9474	surface target, inverted signal
102	123.56	202.11	0.09	0.09	0.36461	-7	147	0.8727	surface target, inverted signal
103	120.75	204.78	0.19	0.15	2.08363	9	158	0.8837	multiple targets extend S & W 1m
104	119.57	207.63	0.03	0.08	0.29039	8	95	0.8883	surface target, inverted signal
105	101.34	192.87	0.56	0.30	16.09405	16	2	0.9728	large target with clutter all around
106	102.70	196.61	0.11	0.24	8.11020	-12	28	0.5516	very poor fit, likely multiple targets
107	105.05	199.14	0.21	0.43	46.37194	-58	316	0.3209	terrible fit, target cant be this big
108	100.25	199.91	0.02	0.09	0.43452	-9	11	0.9478	surface target
109	95.52	196.03	0.13	0.13	1.14003	4	276	0.9574	surface target, inverted signal
110	98.03	205.11	0.40	0.20	4.80782	-31	27	0.9641	this is multiple targets, likely not this deep
111	99.93	212.50	0.07	0.07	0.19177	8	29	0.9945	surface target
112	94.81	206.73	0.06	0.07	0.16487	7	334	0.9721	surface target
113	89.39	208.86	0.10	0.10	0.50222	6	45	0.9809	surface target
114	88.24	210.13	0.10	0.06	0.09938	-2	8	0.9843	near surface target
115	85.20	190.06	0.04	0.10	0.60853	-3	334	0.9456	several surface clutter targets
116	77.32	189.40	0.08	0.09	0.38938	13	312	0.9915	surface target
117	71.96	187.29	0.04	0.13	1.26322	-6	339	0.9348	larget surface target
118	69.48	189.65	0.06	0.04	0.02449	77	251	0.8908	small surface target
119	77.29	191.85	0.05	0.04	0.03155	49	3	0.9342	small surface target
120	80.68	195.38	0.11	0.06	0.10568	7	12	0.9625	small surface target
121	82.36	197.45	0.28	0.06	0.12499	26	16	0.8028	small target, poor fit
122	83.37	196.52	0.00	0.06	0.09470	-4	338	0.9897	surface target
123	88.97	193.60	0.05	0.05	0.05859	-7	24	0.9921	surface target
124	88.62	195.01	0.04	0.05	0.06951	10	316	0.9773	surface target
125	83.80	201.80	0.10	0.06	0.13884	-4	355	0.9768	near surface target
126	78.59	206.42	0.07	0.04	0.03679	7	9	0.9892	near surface small target
127	72.62	209.42	0.02	0.05	0.08717	10	29	0.9709	surface target
128	66.39	209.95	0.11	0.09	0.35426	7	358	0.9820	surface target
129	66.39	209.95	0.11	0.09	0.35426	7	358	0.9820	target will not fit, may be 2 targets
130	66.39	209.95	0.11	0.09	0.35426	7	358	0.9820	target will not fit, may be 2 targets
131	62.73	210.30	0.16	0.05	0.08189	-8	48	0.9806	near surface target
132	60.17	209.69	0.06	0.05	0.06411	4	41	0.9923	surface target

Table 8. Continued.

Target ID	Local X (m)	Local Y (m)	Depth (m)	Size (m)	Moment	Inclin.	Azim.	Fit Quality	Analyst Comments
133	57.88	192.34	0.05	0.10	0.53082	6	8	0.9869	surface target
134	45.42	192.84	0.08	0.10	0.52677	9	8	0.8527	surface target
135	43.77	192.62	0.15	0.06	0.13744	6	350	0.8642	near surface target
136	39.08	185.54	0.06	0.08	0.25020	47	356	0.9579	surface target
137	44.27	196.26	0.05	0.05	0.06326	30	336	0.9765	surface target
138	40.21	198.74	0.08	0.05	0.05616	38	83	0.5889	surface target
139	35.87	194.05	0.08	0.04	0.03648	35	347	0.9621	surface target
140	28.44	203.61	0.07	0.04	0.03628	19	46	0.9454	surface target
141	28.44	203.61	0.07	0.04	0.03628	19	46	0.9454	near surface target, will not converge
142	14.53	196.54	0.07	0.05	0.05614	7	21	0.7863	surface target
143	12.50	196.07	0.10	0.09	0.41975	29	308	0.9767	surface target
144	15.77	207.57	0.02	0.04	0.04388	-9	17	0.9801	surface target
145	25.56	219.79	0.37	0.16	2.27482	44	20	0.9909	good target
146	12.36	222.20	0.05	0.05	0.07383	8	356	0.9908	small,shallow
147	15.00	227.94	0.04	0.06	0.12868	13	347	0.9939	small,shallow
148	26.74	232.75	0.08	0.04	0.03380	48	41	0.9864	small,shallow
149	28.00	228.37	0.04	0.03	0.02406	27	34	0.9795	small,shallow
150	31.13	230.31	0.06	0.04	0.03189	32	47	0.9418	small,shallow
151	32.27	217.45	0.35	0.12	1.09300	-11	307	0.5958	Poor fit,clutter on surface
152	33.89	227.80	0.05	0.04	0.02861	22	2	0.9795	small,shallow
153	38.46	224.58	0.09	0.03	0.00964	11	48	0.9653	small,shallow
154	38.68	228.36	0.06	0.03	0.02081	58	355	0.9806	small,shallow
155	43.22	222.79	0.08	0.05	0.05527	8	348	0.9653	small,shallow
156	42.80	227.74	0.11	0.07	0.18811	6	50	0.9472	small,shallow
157	47.07	231.92	0.01	0.03	0.01820	21	41	0.9844	small,shallow
158	55.68	229.68	0.07	0.13	1.21152	24	23	0.9308	shallow
159	59.27	228.47	0.15	0.06	0.10818	6	11	0.9919	
160	60.22	222.37	0.42	0.23	7.16000	37	16	0.9882	good target
161	58.31	215.84	0.04	0.05	0.05560	1	12	0.9965	
162	67.67	228.36	0.02	0.04	0.04845	-1	358	0.9746	
163	67.26	225.14	0.03	0.07	0.18022	-2	31	0.9882	
164	73.83	220.77	0.39	0.25	8.56730	8	21	0.9971	nearby clutter
165	83.77	226.22	0.19	0.06	0.09670	1	69	0.9785	

Table 8. Continued.

Target ID	Local X (m)	Local Y (m)	Depth (m)	Size (m)	Moment	Inclin.	Azim.	Fit Quality	Analyst Comments
166	84.16	221.69	0.01	0.07	0.21726	-2	76	0.9811	
167	83.58	218.19	0.08	0.05	0.05787	0	57	0.9936	
168	84.80	216.12	0.05	0.04	0.02653	-18	66	0.9896	
169	85.99	212.49	0.06	0.04	0.03097	-12	28	0.9908	
170	87.45	224.65	0.28	0.16	2.47468	0	72	0.9909	nearby clutter
171	90.28	221.50	0.25	0.14	1.63127	1	77	0.9714	nearby clutter
172	92.64	225.10	0.14	0.06	0.14154	-5	39	0.9126	
173	98.47	220.55	0.04	0.05	0.06039	16	32	0.9859	
174	101.61	220.07	0.38	0.07	0.15698	27	58	0.9167	poor fit,small shallow
175	108.53	213.23	0.14	0.11	0.83210	2	57	0.9795	
176	111.85	213.49	0.11	0.07	0.22079	-1	68	0.9188	
177	99.91	223.54	0.07	0.10	0.64292	15	83	0.9495	
178	101.70	223.57	0.00	0.06	0.10280	7	73	0.9748	
179	104.50	225.85	0.03	0.06	0.09921	12	79	0.9962	
180	107.65	226.12	0.06	0.05	0.08769	17	70	0.9721	
181	109.24	221.84	0.04	0.05	0.06323	17	70	0.9409	
182	112.43	221.75	0.13	0.06	0.11918	4	67	0.8652	poor fit
183	112.93	224.69	0.09	0.06	0.09632	-17	99	0.9085	
184	116.00	227.96	0.11	0.06	0.10041	12	76	0.9857	
185	116.67	225.66	0.04	0.04	0.02619	9	123	0.9838	
186	116.39	219.62	0.08	0.04	0.04575	-17	120	0.9879	
187	121.33	217.69	0.16	0.06	0.11741	4	139	0.8350	poor fit
188	93.29	235.67	0.07	0.04	0.04926	20	40	0.9819	
189	97.76	234.87	0.07	0.04	0.02557	13	42	0.9776	
190	100.12	233.99	0.03	0.09	0.41630	10	42	0.9954	
191	106.03	232.01	0.06	0.09	0.47155	3	30	0.9955	
192	108.11	231.39	0.02	0.05	0.06461	9	98	0.8913	poor fit
193	106.84	236.60	0.07	0.05	0.08154	-5	54	0.8957	poor fit
194	111.04	236.85	0.14	0.10	0.53248	3	90	0.9880	
195	118.05	237.41	0.09	0.08	0.34626	1	97	0.9618	
196	120.71	235.31	0.08	0.05	0.06954	1	141	0.9869	
197	122.07	227.18	0.08	0.06	0.13930	33	135	0.9827	
198	119.10	210.27	0.09	0.05	0.05762	-2	112	0.9811	

Table 8. Continued.

Target ID	Local X (m)	Local Y (m)	Depth (m)	Size (m)	Moment	Inclin.	Azim.	Fit Quality	Analyst Comments
199	123.55	212.62	0.05	0.04	0.03595	18	83	0.9881	
200	126.23	213.83	0.05	0.05	0.05858	-22	164	0.9682	
201	129.98	216.19	0.07	0.04	0.04200	6	183	0.9925	
202	134.24	212.91	0.07	0.07	0.16547	31	120	0.9832	
203	136.09	216.33	0.09	0.04	0.04865	2	147	0.9895	
204	139.08	213.09	0.20	0.06	0.09531	2	127	0.8338	poor fit
205	144.19	214.87	0.30	0.22	6.20368	38	142	0.9916	
206	146.64	216.98	0.04	0.04	0.04641	-8	188	0.9733	
207	126.01	221.97	0.03	0.06	0.10364	20	120	0.9796	
208	131.21	229.43	0.11	0.10	0.51420	-6	111	0.9906	
209	135.72	228.96	0.68	0.25	8.64382	25	125	0.9837	
210	139.07	232.94	0.10	0.10	0.52048	-1	113	0.9475	
211	150.96	223.43	0.06	0.08	0.24238	-3	134	0.9430	
212	152.96	226.69	0.44	0.25	8.97647	12	151	0.9872	
213	150.70	231.24	0.07	0.03	0.01889	5	129	0.9834	
214	154.89	233.75	0.10	0.04	0.03227	3	130	0.9849	
215	157.49	234.37	0.05	0.03	0.01257	2	107	0.9789	
216	162.01	236.07	0.08	0.05	0.07050	-6	126	0.7683	poor fit
217	169.11	234.80	0.02	0.06	0.10340	10	186	0.9788	poor fit
218	158.06	220.74	0.06	0.03	0.02334	27	110	0.9012	
219	162.78	221.14	0.09	0.08	0.26524	9	67	0.9064	
220	161.49	213.15	0.10	0.04	0.02599	13	120	0.9634	
221	165.77	210.80	0.10	0.06	0.14566	2	151	0.9615	
222	167.75	211.37	0.00	0.03	0.02038	6	173	0.9684	
223	175.95	216.19	0.60	0.20	4.89959	24	169	0.9959	
224	180.54	214.20	0.06	0.03	0.01849	7	115	0.9758	
225	202.06	238.74	0.05	0.04	0.04964	11	354	0.8980	
226	218.68	229.77	0.45	0.06	0.15162	85	161	0.9730	
227	221.25	217.22	0.07	0.03	0.01377	54	11	0.9448	
228	226.45	238.94	0.05	0.06	0.09854	11	326	0.8692	poor fit
229	310.84	229.22	0.08	0.04	0.05114	11	279	0.9843	
230	310.20	230.89	0.07	0.05	0.05290	34	275	0.9586	
231	302.77	253.78	0.02	0.06	0.15263	-20	18	0.8452	bad fit,several small objects?

Table 8. Continued.

Target ID	Local X (m)	Local Y (m)	Depth (m)	Size (m)	Moment	Inclin.	Azim.	Fit Quality	Analyst Comments
232	284.38	254.04	0.08	0.05	0.08799	36	25	0.9928	
233	267.43	268.95	0.11	0.03	0.02426	54	18	0.9088	
234	265.85	262.92	0.08	0.03	0.01113	22	37	0.9800	
235	218.35	256.06	0.00	0.03	0.01379	-9	98	0.4185	poor fit
236	179.13	256.61	0.14	0.12	1.04374	21	48	0.9245	
237	175.33	262.14	0.05	0.03	0.02170	5	103	0.9895	
238	166.63	260.59	0.16	0.05	0.06888	83	252	0.8550	poor fit
239	163.46	256.92	0.05	0.03	0.01406	7	105	0.9851	
240	160.30	251.28	0.28	0.05	0.07182	-4	120	0.9802	
241	165.16	244.32	0.06	0.04	0.04382	11	101	0.9898	
242	154.90	242.32	0.09	0.07	0.17813	10	58	0.9639	
243	152.58	239.84	0.00	0.04	0.03248	18	23	0.9647	
244	158.04	266.06	0.04	0.04	0.02582	17	357	0.9872	
245	148.57	270.34	0.40	0.05	0.09386	41	122	0.9846	
246	145.46	262.62	0.31	0.21	5.05008	56	89	0.9897	
247	147.64	256.17	0.08	0.06	0.10045	-2	31	0.9439	
248	140.67	252.28	0.08	0.05	0.05927	2	117	0.9270	
249	143.52	250.28	0.07	0.09	0.40450	3	109	0.9022	
250	137.11	251.03	0.03	0.03	0.01330	-4	122	0.9823	
251	135.94	248.52	0.04	0.04	0.03695	9	69	0.9914	
252	135.76	246.75	0.03	0.03	0.01616	6	121	0.9820	
253	137.69	242.29	0.08	0.08	0.33712	7	111	0.9232	
254	133.10	246.04	0.30	0.14	1.48378	-4	6	0.9211	
255	119.60	242.98	0.06	0.09	0.44267	-6	92	0.9898	
256	122.45	247.65	0.06	0.12	0.98946	9	90	0.9842	
257	120.23	258.93	0.08	0.09	0.36609	22	92	0.9715	
258	131.88	260.22	0.15	0.08	0.27684	-1	76	0.9915	
259	118.13	268.12	0.06	0.07	0.16333	10	45	0.9974	
260	116.71	266.78	0.07	0.06	0.14307	4	71	0.9473	
261	114.43	264.66	0.39	0.07	0.17683	36	78	0.9667	
262	114.47	256.60	0.03	0.07	0.22405	4	68	0.9705	
263	118.26	251.06	0.03	0.04	0.04792	26	79	0.9632	
264	106.21	246.89	0.13	0.13	1.36668	4	59	0.9322	

Table 8. Continued.

Target ID	Local X (m)	Local Y (m)	Depth (m)	Size (m)	Moment	Inclin.	Azim.	Fit Quality	Analyst Comments
265	102.10	244.81	0.06	0.11	0.66049	-1	87	0.9950	
266	103.61	241.45	0.07	0.06	0.14511	33	346	0.9878	
267	98.77	241.54	0.00	0.09	0.37853	-1	64	0.9966	
268	96.85	247.42	0.47	0.16	2.41403	9	68	0.8835	
269	100.66	252.35	0.34	0.07	0.21184	31	76	0.9777	
270	87.81	265.69	0.04	0.06	0.10620	11	82	0.9430	
271	85.93	265.87	0.05	0.06	0.14694	0	7	0.9686	
272	88.17	258.47	0.46	0.19	4.06426	12	51	0.9698	
273	87.13	259.93	0.07	0.08	0.26206	11	18	0.9702	
274	89.67	260.21	0.01	0.03	0.01658	-1	61	0.8746	
275	85.87	256.39	0.05	0.06	0.10867	21	53	0.9285	
276	86.07	251.99	0.06	0.07	0.23078	7	41	0.9489	
277	82.52	250.42	0.06	0.06	0.15281	-1	36	0.9362	
278	78.35	246.72	0.06	0.07	0.22061	-6	64	0.9949	
279	78.00	258.93	0.07	0.05	0.06650	-6	35	0.9773	
280	72.97	256.38	0.06	0.05	0.06271	-3	63	0.9429	
281	70.26	249.03	0.09	0.06	0.10394	7	91	0.9754	
282	65.07	247.43	0.09	0.10	0.57730	-7	72	0.9286	
283	67.40	260.83	0.17	0.19	3.61673	-9	30	0.9187	
284	67.85	268.02	0.07	0.04	0.03764	8	54	0.9739	
285	55.06	263.33	0.08	0.16	2.25066	6	55	0.9714	
286	56.46	271.45	0.03	0.04	0.04068	1	53	0.9850	
287	47.53	269.09	0.18	0.06	0.10161	6	53	0.9790	
288	38.50	267.97	0.06	0.11	0.72619	5	64	0.9834	
289	36.39	266.47	0.04	0.04	0.03139	23	21	0.9901	
290	34.43	246.39	0.06	0.08	0.28420	11	24	0.9910	
291	32.32	241.46	0.08	0.06	0.14088	8	34	0.9423	
292	23.29	243.67	0.32	0.06	0.13943	32	60	0.9262	
293	14.27	279.67	0.07	0.12	0.97838	7	22	0.9776	
294	15.76	278.24	0.32	0.05	0.05267	53	14	0.9610	
295	31.25	279.78	0.34	0.16	2.37472	52	26	0.9648	
296	32.05	285.78	0.08	0.04	0.03742	3	348	0.9756	
297	43.59	277.37	0.04	0.04	0.04141	33	340	0.9820	

Table 8. Continued.

Target ID	Local X (m)	Local Y (m)	Depth (m)	Size (m)	Moment	Inclin.	Azim.	Fit Quality	Analyst Comments
298	45.79	276.64	0.05	0.03	0.01762	10	72	0.9804	
299	63.01	290.87	0.10	0.04	0.04795	-7	11	0.9804	
300	73.60	295.28	0.09	0.12	1.10745	4	2	0.9585	
301	66.80	286.80	0.06	0.04	0.02822	40	18	0.9623	
302	69.16	273.20	0.05	0.05	0.05193	9	347	0.9724	
303	70.55	279.04	0.07	0.04	0.04226	-3	71	0.9563	
304	75.48	285.73	0.17	0.10	0.56102	80	26	0.4179	Targ must have been dug over the weekend
305	77.97	285.83	0.03	0.03	0.02388	41	29	0.9435	
306	101.51	299.51	0.02	0.05	0.08615	12	8	0.9829	
307	106.50	287.90	0.07	0.04	0.03201	9	53	0.9241	
308	105.92	283.43	0.04	0.04	0.03216	26	36	0.9429	
309	117.42	284.20	0.32	0.07	0.19755	32	47	0.9485	
310	120.42	286.20	0.26	0.08	0.24458	46	72	0.9470	
311	133.26	281.72	0.06	0.04	0.02786	20	37	0.9868	
312	137.95	275.66	0.22	0.05	0.07966	-13	103	0.9810	
313	144.35	273.60	0.01	0.04	0.02685	4	12	0.9883	
314	151.15	286.21	0.14	0.14	1.40290	23	47	0.8982	
315	152.10	279.26	0.03	0.03	0.01946	14	77	0.9824	
316	166.84	279.09	0.08	0.06	0.14157	18	72	0.9935	
317	163.83	282.69	0.07	0.05	0.06733	34	32	0.9156	
318	177.78	295.52	0.03	0.07	0.20792	14	6	0.9763	
319	183.68	279.50	0.18	0.03	0.02273	81	196	0.9551	
320	206.43	285.95	0.03	0.06	0.10239	5	324	0.9721	
321	224.51	301.06	0.87	0.10	0.64661	-4	3	0.9432	
322	227.21	278.97	0.05	0.03	0.01473	44	75	0.9182	
323	325.69	309.98	0.05	0.03	0.02099	11	198	0.9684	
324	309.42	325.75	0.06	0.11	0.71310	5	7	0.9686	
325	285.59	318.39	0.07	0.06	0.14636	52	89	0.9525	
326	259.93	329.83	0.06	0.05	0.05709	59	44	0.9939	
327	246.41	302.77	0.09	0.05	0.09318	2	64	0.9393	
328	234.80	298.47	0.01	0.05	0.06532	17	44	0.9804	
329	198.04	307.54	0.05	0.04	0.02608	8	53	0.9793	
330	171.11	328.90	0.05	0.04	0.02906	7	341	0.9878	

Table 8. Continued.

Target ID	Local X (m)	Local Y (m)	Depth (m)	Size (m)	Moment	Inclin.	Azim.	Fit Quality	Analyst Comments
331	170.86	322.96	0.02	0.05	0.06938	8	13	0.9924	
332	166.80	307.81	0.08	0.04	0.04563	15	358	0.9617	
333	156.83	319.53	0.04	0.05	0.05191	38	83	0.9838	
334	142.36	305.23	0.08	0.04	0.04740	6	271	0.9640	
335	141.24	310.19	0.35	0.10	0.51472	34	12	0.9917	
336	125.63	318.82	0.15	0.16	2.35795	11	82	0.9694	
337	127.35	319.47	0.02	0.03	0.01626	8	85	0.8919	
338	112.23	308.91	0.09	0.05	0.09449	8	114	0.8604	
339	110.85	314.02	0.04	0.08	0.25436	2	86	0.9966	
340	110.64	328.85	0.08	0.04	0.04016	33	2	0.9764	
341	100.93	326.32	0.11	0.04	0.03924	61	66	0.8648	
342	99.39	322.11	0.00	0.05	0.05790	26	8	0.9260	
343	102.93	318.58	0.13	0.05	0.08812	11	1	0.9829	
344	88.93	308.21	0.06	0.03	0.02213	10	45	0.9804	
345	65.92	309.19	0.08	0.04	0.03248	33	41	0.9920	
346	63.44	325.47	0.03	0.04	0.04558	0	28	0.7347	
347	68.98	299.86	0.00	0.04	0.04945	67	355	0.8322	
348	31.80	300.27	0.00	0.04	0.05139	25	11	0.9856	
349	29.42	305.53	0.09	0.05	0.08173	69	7	0.9739	
350	28.29	313.62	0.04	0.07	0.16058	25	7	0.9833	
351	26.88	318.48	0.00	0.03	0.01556	60	2	0.9854	
352	11.98	319.47	0.06	0.04	0.04222	3	23	0.9775	
353	27.19	341.37	0.06	0.04	0.03527	0	67	0.9842	
354	39.67	335.33	0.04	0.03	0.01549	2	29	0.9682	
355	115.22	335.26	0.07	0.08	0.28090	27	48	0.9816	
356	128.67	332.33	0.70	0.16	2.43456	45	96	0.9851	
357	137.31	332.10	0.00	0.04	0.03180	-2	30	0.9139	
358	145.61	331.84	0.03	0.03	0.01662	4	8	0.9147	
359	185.10	332.80	0.04	0.03	0.02249	4	14	0.9711	
360	201.04	-37.85	0.07	0.03	0.02198	-1	35	0.9831	
361	189.77	-37.87	0.07	0.03	0.02404	42	346	0.8865	
362	167.73	-39.56	0.05	0.03	0.01146	6	18	0.9531	
363	142.62	-26.46	0.55	0.07	0.20727	40	352	0.7957	

Table 8. Continued.

Target ID	Local X (m)	Local Y (m)	Depth (m)	Size (m)	Moment	Inclin.	Azim.	Fit Quality	Analyst Comments
364	167.09	-7.72	0.35	0.05	0.05915	86	17	0.8896	
365	179.27	-26.01	0.13	0.03	0.02344	40	58	0.9705	
366	183.79	-14.43	0.63	0.17	2.71732	2	354	0.9922	
367	184.26	-17.83	0.13	0.04	0.04702	60	190	0.7579	
368	213.26	-5.68	0.63	0.08	0.28147	31	24	0.9687	
369	213.59	-2.98	0.08	0.04	0.04584	-13	331	0.9916	
370	329.56	-11.26	0.08	0.03	0.01905	27	334	0.9736	
371	340.64	11.55	0.52	0.08	0.24296	11	346	0.8794	
372	288.49	18.44	0.02	0.05	0.09344	-2	359	0.9796	
373	251.77	6.69	0.06	0.03	0.02155	11	337	0.9783	
374	214.19	25.29	0.02	0.04	0.02532	49	40	0.9660	
375	200.40	2.46	0.08	0.04	0.02832	15	62	0.9342	
376	186.57	3.27	0.05	0.04	0.02453	8	12	0.9583	
377	176.59	28.15	0.33	0.04	0.05080	65	154	0.9610	
378	160.81	13.51	0.68	0.08	0.31920	26	12	0.9707	
379	151.02	27.30	0.30	0.05	0.07699	73	301	0.9395	
380	143.49	22.69	0.43	0.05	0.09141	79	73	0.9490	
381	145.93	35.44	0.36	0.13	1.15758	14	4	0.9845	
382	136.30	41.44	0.06	0.05	0.09291	4	5	0.9971	
383	141.35	47.40	0.42	0.11	0.85263	6	18	0.9821	
384	146.82	59.76	0.02	0.06	0.09565	8	358	0.9865	
385	140.26	59.27	0.35	0.04	0.05073	77	83	0.9274	
386	188.51	59.34	0.38	0.18	3.20891	76	304	0.9791	
387	226.44	42.84	0.38	0.14	1.42541	53	312	0.9963	
388	224.29	51.02	0.04	0.04	0.03671	35	292	0.9622	
389	235.90	58.69	0.18	0.04	0.03889	16	137	0.9384	
390	268.56	45.01	0.26	0.07	0.16213	-5	239	0.9553	
391	346.65	35.43	0.04	0.04	0.03188	8	17	0.9783	
392	330.06	60.49	0.05	0.03	0.01106	23	55	0.9846	
393	342.49	76.06	0.04	0.06	0.10653	10	3	0.8991	
394	339.39	84.12	2.39	0.17	2.59303	6	18	0.9385	
395	327.68	84.34	0.02	0.05	0.05930	20	342	0.9923	
396	266.73	91.05	2.28	0.21	5.38964	3	309	0.9871	

Table 8. Continued.

Target ID	Local X (m)	Local Y (m)	Depth (m)	Size (m)	Moment	Inclin.	Azim.	Fit Quality	Analyst Comments
397	254.43	86.50	0.43	0.16	2.22876	61	321	0.9908	
398	243.82	65.33	0.08	0.04	0.03990	1	347	0.9685	
399	217.56	70.31	0.79	0.07	0.17823	9	6	0.8733	
400	220.20	90.52	0.04	0.03	0.01886	29	348	0.9457	
401	210.67	91.77	0.04	0.04	0.02721	7	346	0.9887	
402	178.83	75.84	0.78	0.16	2.33507	40	261	0.9865	
403	172.94	71.79	0.14	0.05	0.09154	11	356	0.8249	
404	160.54	71.37	0.03	0.05	0.05917	7	328	0.9890	
405	159.42	70.61	0.04	0.04	0.02479	3	331	0.9857	
406	153.22	68.48	0.41	0.22	6.06735	58	339	0.9940	
407	158.70	75.14	0.08	0.04	0.03883	12	302	0.9853	
408	155.13	74.75	0.02	0.12	1.05600	38	1	0.9252	
409	160.76	83.31	0.35	0.18	3.20436	54	275	0.9755	
410	160.90	87.22	0.04	0.04	0.04733	65	84	0.9553	
411	160.32	90.76	0.01	0.05	0.07384	9	348	0.9725	
412	151.83	86.93	0.07	0.03	0.02411	5	16	0.7773	
413	146.38	67.97	0.57	0.08	0.30264	25	351	0.9216	
414	145.33	73.34	0.39	0.19	3.95988	57	294	0.9589	
415	141.88	74.92	0.78	0.14	1.66390	16	329	0.9710	
416	145.42	79.20	0.37	0.08	0.28382	50	14	0.9839	
417	143.07	80.76	0.02	0.05	0.07824	6	345	0.9759	
418	136.88	82.76	0.01	0.04	0.02918	4	6	0.8822	
419	137.51	85.96	0.01	0.09	0.36439	-1	296	0.9865	
420	140.52	83.73	0.08	0.05	0.06479	30	328	0.9849	
421	138.14	91.80	0.27	0.07	0.18014	29	356	0.9540	
422	139.13	98.34	1.18	0.16	2.48442	19	13	0.9736	
423	144.09	97.34	0.30	0.17	2.95611	43	285	0.9872	
424	144.08	94.29	0.79	0.17	2.69166	8	343	0.9513	
425	137.20	94.51	0.04	0.06	0.11234	8	323	0.9490	
426	141.03	103.32	0.04	0.06	0.10010	20	333	0.9921	
427	145.52	101.55	0.13	0.04	0.03993	16	286	0.9699	
428	150.12	109.56	0.10	0.07	0.17310	47	255	0.9285	
429	141.16	115.68	0.49	0.12	1.00248	17	350	0.9333	

Table 8. Continued.

Target ID	Local X (m)	Local Y (m)	Depth (m)	Size (m)	Moment	Inclin.	Azim.	Fit Quality	Analyst Comments
430	140.66	120.50	1.37	0.17	2.58962	32	2	0.9677	
431	145.08	120.87	0.03	0.04	0.02651	11	345	0.9888	
432	149.84	121.52	0.09	0.05	0.08582	7	248	0.9673	
433	157.84	119.66	0.55	0.20	4.24528	52	261	0.9901	
434	160.34	119.48	0.06	0.04	0.03018	14	334	0.9511	
435	166.48	114.52	0.07	0.04	0.04217	27	321	0.8991	
436	166.07	109.13	0.05	0.06	0.10907	8	17	0.9839	
437	159.66	100.86	0.00	0.04	0.03494	19	329	0.9053	
438	177.38	108.23	0.25	0.04	0.04261	49	293	0.9533	
439	182.19	104.76	2.54	0.19	4.04303	4	14	0.9586	
440	181.02	102.56	0.09	0.03	0.01605	50	293	0.9158	
441	196.38	115.72	0.11	0.05	0.06225	23	258	0.9561	
442	209.35	120.38	0.00	0.05	0.05661	6	291	0.9543	
443	225.98	96.51	0.51	0.16	2.50969	62	287	0.9842	
444	232.26	92.69	0.03	0.03	0.02066	24	359	0.9807	
445	229.32	119.25	0.04	0.04	0.02845	43	48	0.9804	
446	260.19	121.32	0.24	0.09	0.48014	69	130	0.9864	
447	271.16	97.98	0.08	0.03	0.02075	52	19	0.9566	
448	277.58	101.73	0.49	0.17	2.92923	85	67	0.9585	
449	282.16	100.54	0.02	0.11	0.76735	63	88	0.8829	
450	351.05	109.00	2.04	0.18	3.11449	3	101	0.9709	
451	330.40	142.57	0.24	0.16	2.42966	80	25	0.9847	
452	315.43	131.53	0.26	0.16	2.54215	86	83	0.9949	
453	307.24	123.66	0.06	0.03	0.02411	1	329	0.9961	
454	293.41	147.23	0.29	0.19	3.79989	89	98	0.9743	
455	295.54	145.62	0.04	0.06	0.14640	15	16	0.9865	
456	261.87	130.91	0.21	0.15	1.87613	67	10	0.9788	
457	260.54	132.75	0.22	0.09	0.36108	52	62	0.9809	
458	237.83	134.24	0.26	0.09	0.36870	63	321	0.9648	
459	237.73	126.35	0.09	0.04	0.02749	28	28	0.9633	
460	193.97	138.40	0.07	0.03	0.02249	5	251	0.9611	
461	173.30	134.91	0.04	0.04	0.03355	9	329	0.9895	
462	162.79	128.68	0.08	0.06	0.14711	3	240	0.9522	Remnant Magnetization

Table 8. Continued.

Target ID	Local X (m)	Local Y (m)	Depth (m)	Size (m)	Moment	Inclin.	Azim.	Fit Quality	Analyst Comments
463	162.66	135.02	0.03	0.05	0.09248	1	8	0.9326	
464	164.25	137.50	0.11	0.06	0.12409	21	329	0.8476	
465	172.25	145.74	0.06	0.04	0.03878	0	303	0.9606	
466	169.44	146.41	0.25	0.06	0.12450	45	206	0.9730	Remnant Magnetization
467	167.05	147.59	0.15	0.05	0.07375	10	238	0.9880	Remnant Magnetization
468	164.07	145.17	0.47	0.26	9.54660	88	113	0.9279	
469	154.26	147.08	0.44	0.20	4.25075	40	231	0.9791	Remnant Magnetization
470	152.78	142.70	0.05	0.04	0.04013	14	271	0.9840	Remnant Magnetization
471	148.10	139.28	0.28	0.06	0.12210	62	255	0.9831	
472	136.85	132.30	0.07	0.08	0.24556	-14	262	0.9211	Remnant Magnetization
473	241.17	152.98	0.34	0.19	4.06376	74	257	0.9859	
474	162.98	295.06	0.00	0.07	0.23293	77	23	0.8841	small target on surface
475	163.69	291.55	0.00	0.05	0.08434	69	170	0.8794	small target on surface
476	30.26	283.33	0.00	0.03	0.02198	36	355	0.9368	small target on surface
477	41.10	253.07	0.00	0.03	0.01288	28	341	0.7153	very small target on surface
478	82.92	248.63	0.00	0.04	0.02918	68	64	0.8944	small target on surface
479	80.85	277.31	0.00	0.06	0.12924	29	340	0.9328	small target on surface
480	101.42	265.98	0.05	0.04	0.04215	1	41	0.9844	small target near surface
481	134.13	287.15	0.03	0.04	0.04567	24	341	0.9730	small target on surface
482	127.53	273.01	0.07	0.04	0.04715	4	121	0.8705	small target near surface
483	151.40	124.02	0.05	0.05	0.06077	57	328	0.9585	small targ at surface
484	137.67	125.79	0.01	0.06	0.12218	3	342	0.9070	small targ on surface
485	219.92	104.67	0.01	0.05	0.06745	29	283	0.9160	EM targ 34, small targ on surface
486	198.52	127.62	0.27	0.03	0.01792	61	209	0.8846	EM targ 44
487	171.76	132.83	0.00	0.03	0.02279	26	266	0.8225	EM targ 42, small targ on surface
488	181.28	136.86	0.04	0.03	0.00887	40	286	0.7294	mag targ 40
489	188.84	145.36	0.50	0.04	0.04946	54	302	0.8146	EM targ 43
490	131.36	164.69	0.04	0.05	0.06947	10	262	0.9503	mag targ on surface
491	142.29	179.47	0.05	0.05	0.05948	20	257	0.9913	small targ on surface
492	148.40	179.53	0.01	0.05	0.05529	-13	227	0.9707	small targ on surface
493	159.32	179.73	0.13	0.04	0.04059	53	196	0.9551	small targ near surface
494	192.20	175.25	0.08	0.03	0.01517	75	347	0.9743	small targ near surface
495	216.96	-41.62	0.43	0.05	0.05203	69	25	0.9227	EM TARGET #4

Table 8. Continued.

Target ID	Local X (m)	Local Y (m)	Depth (m)	Size (m)	Moment	Inclin.	Azim.	Fit Quality	Analyst Comments
496	290.29	-18.68	0.31	0.07	0.17647	34	11	0.2027	EM Target #8
497	278.72	94.85	0.04	0.13	1.17635	79	53	0.6722	EM Targ 33
498	85.31	171.91	0.10	0.04	0.02638	38	350	0.8060	surface target
499	87.77	176.18	0.07	0.06	0.14495	-5	339	0.9875	surface target
500	96.85	165.57	0.33	0.10	0.58117	51	360	0.9690	medium target, shallow
501	92.44	26.01	0.34	0.11	0.76827	64	1	0.9826	medium target at 1 ft
502	102.34	14.09	0.50	0.12	1.09544	28	0	0.9587	partial signature, M38
503	100.76	26.34	0.34	0.04	0.03712	87	90	0.9194	small target at 1 ft
504	108.23	21.40	0.29	0.04	0.03205	80	355	0.9284	small target at 1 ft
505	111.07	16.73	0.25	0.04	0.03534	36	26	0.8364	small target at 1 ft
506	120.39	13.37	0.06	0.03	0.01369	18	347	0.9101	20mm?
507	117.52	23.20	0.03	0.03	0.01297	25	347	0.9736	20mm?
508	127.64	15.83	0.03	0.03	0.01319	67	83	0.9211	20mm?
509	131.87	18.73	0.08	0.06	0.14256	37	315	0.9505	small target, near surface
510	130.35	23.11	0.16	0.04	0.02569	75	84	0.9619	scrap, near surface
511	131.47	27.86	0.02	0.06	0.09688	13	324	0.9797	surface target
512	123.67	27.09	0.21	0.04	0.03799	88	67	0.9396	small target, near surface
513	125.09	42.17	0.51	0.06	0.13106	67	39	0.9410	small target
514	129.86	44.24	0.04	0.04	0.05089	39	347	0.9886	surface target
515	126.85	48.23	0.47	0.06	0.12533	87	90	0.9566	small target
516	120.90	45.82	0.19	0.03	0.02259	61	342	0.9770	20mm?
517	121.06	50.05	0.35	0.14	1.47987	27	337	0.9874	M38, fins 1.5m south
518	131.82	57.67	0.05	0.04	0.04157	89	187	0.9777	surface scrap
519	122.01	61.22	0.40	0.17	2.78425	55	305	0.9903	M38, scrap 1.5m E & SW
520	130.74	62.02	0.04	0.03	0.02086	67	64	0.9075	small surface target
521	112.07	61.65	0.40	0.09	0.39312	56	355	0.9909	medium target
522	103.03	55.50	0.96	0.16	2.22550	8	5	0.9872	M38, fins 1.5m S & SW
523	95.55	56.95	0.29	0.06	0.14110	60	357	0.9913	small target
524	106.21	49.08	0.47	0.14	1.52084	30	357	0.9719	M38
525	99.20	44.98	0.37	0.14	1.41724	46	5	0.9822	M38
526	108.92	35.14	0.98	0.17	2.98656	16	360	0.9601	M38, fins 1m S
527	83.54	33.52	0.48	0.14	1.46004	31	296	0.9965	M38
528	85.21	51.75	0.28	0.10	0.57488	44	353	0.9921	medium target

Table 8. Continued.

Target ID	Local X (m)	Local Y (m)	Depth (m)	Size (m)	Moment	Inclin.	Azim.	Fit Quality	Analyst Comments
529	89.49	60.56	0.00	0.03	0.01173	30	332	0.9005	small targ on surface
530	44.12	91.69	0.00	0.05	0.06398	60	89	0.8499	surface target
531	64.40	71.96	0.34	0.17	2.65138	55	287	0.9926	M38
532	83.21	72.94	0.55	0.16	2.13145	46	355	0.9938	M38
533	90.45	72.79	0.54	0.17	2.58697	32	294	0.9924	M38
534	91.77	67.38	0.30	0.09	0.47046	38	6	0.9949	medium target at 1 ft
535	99.65	75.62	0.68	0.22	5.74013	33	357	0.9874	M38, scrap 1.5m W
536	102.59	69.95	0.07	0.05	0.08486	69	265	0.8709	surface target
537	104.33	73.87	0.09	0.04	0.04939	54	354	0.8911	small target near surface
538	108.47	71.04	0.36	0.12	1.09694	46	7	0.9896	M38, scrap 1.5m N
539	114.76	69.34	1.14	0.17	2.85206	22	358	0.9835	M38, fins 1.5m S
540	117.54	65.48	0.42	0.05	0.08703	38	9	0.9504	small target
541	112.45	74.10	1.29	0.17	2.71183	14	356	0.9886	M38, see targ 542
542	113.96	74.78	0.39	0.11	0.71408	48	343	0.8978	medium target, see T#541
543	120.52	76.25	1.37	0.17	2.83653	35	352	0.9491	M38
544	120.12	80.06	0.50	0.12	1.02696	7	354	0.9471	M38
545	114.53	78.18	0.61	0.11	0.72696	54	14	0.9264	medium target
546	118.66	83.50	0.47	0.10	0.52337	79	174	0.9715	target with clutter all around
547	122.40	85.47	0.65	0.19	3.78320	72	20	0.7349	this it two targets 1m apart
548	111.25	82.10	1.20	0.17	2.58180	11	1	0.9554	M38, see target T549
549	109.26	82.56	0.28	0.14	1.61332	14	7	0.9838	M38, see target T548
550	102.29	80.49	0.35	0.09	0.38327	40	323	0.9679	medium target
551	110.29	87.33	0.98	0.14	1.42737	21	334	0.9263	M38
552	110.53	90.05	0.30	0.08	0.32495	78	297	0.9681	small target
553	106.63	86.31	0.56	0.11	0.78775	65	215	0.8628	note poor fit
554	104.06	88.95	0.59	0.12	0.98291	31	20	0.9813	medium target
555	99.80	89.48	1.03	0.18	3.37286	13	333	0.9072	M38
556	97.50	89.37	0.87	0.18	3.41583	0	13	0.9749	M38, see T555 &T557
557	94.62	89.58	1.70	0.30	15.85219	17	15	0.9166	this is a cluster of targs with mucho clutter to S
558	127.98	70.83	0.43	0.16	2.28377	59	299	0.9815	M38
559	127.19	76.02	0.66	0.16	2.53016	-3	4	0.9773	M38, fins 1m south
560	127.28	84.55	0.92	0.16	2.39426	11	323	0.9802	M38
561	129.70	88.50	0.28	0.14	1.44034	65	281	0.9863	M38

Table 8. Continued.

Target ID	Local X (m)	Local Y (m)	Depth (m)	Size (m)	Moment	Inclin.	Azim.	Fit Quality	Analyst Comments
562	121.31	93.89	0.06	0.06	0.13850	45	349	0.7712	surface target
563	123.65	98.16	0.40	0.18	3.46617	58	294	0.9826	M38
564	123.92	103.22	0.77	0.13	1.12948	90	119	0.7979	M38?
565	126.71	100.54	0.25	0.07	0.19541	27	338	0.9742	small target
566	130.12	105.21	0.16	0.06	0.11535	39	325	0.9261	small taret
567	122.58	113.66	0.32	0.19	3.61542	49	267	0.9917	M38
568	120.67	115.72	0.51	0.14	1.54976	66	8	0.9402	M38
569	122.06	118.18	0.84	0.15	1.90856	50	5	0.9556	M38
570	118.08	118.76	0.27	0.08	0.32717	51	318	0.9111	small target
571	117.64	116.51	0.70	0.13	1.15488	34	1	0.9669	M38
572	117.12	109.95	0.62	0.14	1.52307	5	6	0.9244	M38
573	114.53	107.36	0.46	0.10	0.49599	22	358	0.9125	medium target
574	112.15	105.71	0.73	0.14	1.49101	45	338	0.8513	M38
575	115.30	100.39	0.40	0.12	1.01385	42	357	0.9758	medium target
576	113.17	97.59	0.51	0.12	1.02223	53	295	0.9254	medium target
577	117.33	92.18	1.10	0.17	2.75845	19	348	0.9190	M38
578	118.27	101.61	0.57	0.17	2.94437	42	293	0.9739	M38
579	110.03	102.08	1.06	0.20	4.54048	26	30	0.8711	this is two targets, look 1m E for second
580	108.63	97.36	0.38	0.12	0.90308	5	14	0.9595	M38
581	104.28	97.86	0.38	0.11	0.77130	5	318	0.9680	medium target
582	104.67	100.93	0.50	0.15	1.81589	-3	356	0.9785	M38
583	97.12	101.54	0.44	0.13	1.11460	49	323	0.9736	medium target
584	95.54	99.27	0.84	0.20	4.56979	32	355	0.9029	M38m fins 2m S
585	93.48	94.23	0.53	0.16	2.14935	-15	6	0.9620	M38
586	103.02	106.11	1.36	0.20	4.37048	20	324	0.8218	this is several targets, shallower than indicated
587	105.75	104.95	0.54	0.13	1.19058	38	10	0.9794	medium target
588	108.09	106.99	0.47	0.09	0.44752	89	15	0.9141	medium target
589	108.11	106.94	0.47	0.09	0.44115	87	246	0.8704	medium target in cluster
590	111.46	108.45	0.29	0.09	0.40547	72	281	0.9696	medium target in cluster
591	112.70	110.20	0.62	0.14	1.46158	43	23	0.9727	medium target in cluster
592	114.73	117.18	0.48	0.22	5.74404	36	260	0.9634	this is several targets in a cluster
593	112.12	115.88	0.88	0.26	9.81782	29	186	0.8783	a cluster of targets
594	111.48	119.95	0.35	0.12	0.86805	71	8	0.9756	target cluster

Table 8. Continued.

Target ID	Local X (m)	Local Y (m)	Depth (m)	Size (m)	Moment	Inclin.	Azim.	Fit Quality	Analyst Comments
595	107.77	120.16	0.38	0.14	1.52653	26	9	0.9375	target cluster
596	106.13	117.61	0.58	0.19	3.77291	20	160	0.8955	target cluster
597	105.41	115.83	0.70	0.29	14.12473	5	329	0.6269	cluster of at least 4 targets
598	106.19	112.40	1.64	0.41	38.44081	21	41	0.7501	multiple targets overlaid
599	102.74	110.87	0.53	0.15	1.97128	-2	17	0.8816	multiple targets
600	99.67	110.13	1.53	0.27	10.67492	21	327	0.8413	multiple targets
601	95.25	113.21	0.36	0.11	0.71179	50	336	0.2235	at least 6 targets, look up to 3m E
602	91.82	117.80	0.61	0.16	2.52770	0	358	0.9610	second target above and to E
603	101.67	120.89	1.41	0.26	9.54105	77	269	0.7898	cluster of at least three targets
604	87.30	104.57	0.10	0.05	0.07766	39	13	0.8943	small target near surface
605	83.59	101.86	0.55	0.15	1.94195	59	318	0.9907	M38
606	80.76	92.52	0.42	0.19	3.94185	67	308	0.9877	M38
607	67.91	103.21	0.47	0.19	3.65250	57	328	0.9882	M38, fins 1m SE
608	66.52	107.67	0.09	0.05	0.08221	28	15	0.9913	small target near surface
609	75.34	119.73	0.75	0.18	3.20566	34	312	0.9721	M38, clutter on the west side
610	42.69	121.96	1.06	0.22	5.90088	18	321	0.9913	M38, partial signature
611	49.88	130.07	0.01	0.05	0.08767	39	284	0.8487	surface trash
612	50.29	139.97	0.11	0.05	0.07910	43	341	0.6778	small target
613	61.18	125.65	0.44	0.24	8.29519	31	352	0.9926	M38
614	71.00	122.14	0.44	0.15	1.84107	17	356	0.9790	M38
615	72.29	134.55	0.49	0.09	0.45940	52	335	0.9572	medium target
616	78.01	139.94	0.92	0.18	3.35964	6	16	0.9876	M38
617	75.36	141.86	0.46	0.25	8.46984	48	319	0.9426	large for an M38
618	91.77	129.87	0.34	0.13	1.39006	10	357	0.9795	medium target
619	89.74	129.80	0.53	0.15	1.92967	4	17	0.9684	M38
620	90.60	123.98	0.78	0.15	1.95768	58	63	0.9447	M38
621	86.07	123.81	1.18	0.27	11.15970	15	339	0.9591	3 additional targets are clustered TO e
622	94.60	138.35	0.46	0.18	3.40653	-17	350	0.9689	M38
623	98.56	142.73	0.76	0.17	3.00414	28	354	0.9310	M38 with fins above
624	94.86	144.11	0.57	0.23	7.29016	51	321	0.9314	M38, partial signature
625	129.48	127.76	0.07	0.08	0.26244	21	5	0.9715	small target on surface
626	123.45	125.89	0.35	0.13	1.21631	67	351	0.9724	medium target
627	118.84	122.87	0.74	0.20	4.75171	58	1	0.8944	M38

Table 8. Continued.

Target ID	Local X (m)	Local Y (m)	Depth (m)	Size (m)	Moment	Inclin.	Azim.	Fit Quality	Analyst Comments
628	118.18	127.02	0.34	0.13	1.30179	3	3	0.9360	medium target
629	116.93	124.18	0.46	0.12	0.94187	26	344	0.8338	medium target
630	117.92	129.88	0.70	0.16	2.15358	25	322	0.9163	likely M38
631	118.33	135.26	1.01	0.14	1.57485	77	188	0.9034	low fit quality
632	117.54	139.85	0.72	0.14	1.47880	18	359	0.9631	M38?
633	118.85	147.39	0.79	0.18	3.41919	77	14	0.9036	M38
634	112.09	139.78	0.94	0.19	4.20514	42	113	0.8277	second target on south edge
635	114.39	137.33	0.25	0.08	0.34885	63	112	0.8358	small target
636	109.42	138.12	0.57	0.16	2.18282	74	160	0.9499	M38?
637	113.80	134.44	0.43	0.10	0.64260	68	114	0.8259	medium target
638	112.01	136.00	0.34	0.13	1.22600	33	335	0.9533	medium target
639	112.89	132.71	0.41	0.14	1.45639	38	1	0.9593	medium target
640	113.25	130.54	0.49	0.14	1.71902	19	7	0.9535	medium target
641	109.07	131.91	0.53	0.15	1.95204	67	339	0.8845	poor fit
642	104.38	132.75	0.70	0.19	3.85206	51	328	0.8745	poor fit
643	100.51	133.98	0.48	0.13	1.27950	47	350	0.9175	medium target
644	99.47	135.75	0.45	0.22	5.72262	3	333	0.9455	M38 likely
645	98.14	133.40	0.65	0.16	2.20353	59	321	0.9585	M38
646	108.38	127.45	0.54	0.14	1.45851	67	90	0.8364	surrounded by 20 more targets
647	101.29	124.26	0.56	0.17	2.58065	59	339	0.9685	targets are so close, they probably are mangled

Table 9. Target Analysis of the EM Survey of BBR Target 2.

Target ID	Local X (m)	Local Y (m)	Depth (m)	Ferrous Size (m)	Non-Ferrous Size (m)	Fit Quality	Analyst Comments
1	142.70	-41.76	0.00	0.020	0.017	0.1589	No Mag signature
2	147.01	-32.99	0.36	0.045	0.068	0.4476	No Mag signature
3	165.43	-33.73	0.28	0.061	0.113	0.8126	Very weak Mag signature
4	216.85	-41.77	0.07	0.042	0.059	0.9558	Weak Mag signature
5	248.01	-31.81	0.00	0.026	0.024	0.7404	Small, no Mag signature
6	356.98	-19.49	0.00	0.027	0.026	0.7836	Surface trash, no Mag
7	352.72	-22.41	0.00	0.022	0.019	0.6229	Surface trash, no Mag
8	290.37	-18.32	0.00	0.021	0.018	0.3471	weird Mag and EM signatures
9	204.80	-0.80	0.25	0.042	0.060	0.6708	Very weak Mag signature
10	172.21	-23.73	0.00	0.033	0.039	0.8864	Surface trash, no Mag
11	137.87	-8.51	0.38	0.071	0.147	0.8992	Small Mag signature
12	147.54	-1.44	0.00	0.032	0.036	0.8783	Surface trash, no Mag
13	148.69	14.31	0.16	0.045	0.067	0.8575	Weak mag signature
14	172.74	17.73	0.04	0.046	0.068	0.8877	Weak Mag signature
15	182.95	2.75	0.13	0.060	0.109	0.8841	Distorted Mag signature
16	213.80	6.57	0.20	0.039	0.051	0.9041	Very weak Mag
17	277.93	8.07	0.00	0.049	0.078	0.9034	Trouble fitting Mag signature
18	340.91	52.02	0.00	0.027	0.026	0.8950	Small, barely seen with Mag
19	249.26	36.84	0.21	0.041	0.056	0.6673	Very weak Mag
20	219.28	49.42	0.00	0.042	0.058	0.5636	No Mag, weird signature
21	205.50	40.63	0.00	0.033	0.038	0.8247	Small near-surface target, no Mag
22	183.48	31.39	0.00	0.026	0.026	0.3845	Small near-surface target, no Mag
23	161.21	53.83	0.45	0.055	0.096	0.3482	Extremely weak Mag signature
24	155.62	44.75	0.00	0.028	0.029	0.8550	Small near-surface target, no Mag
25	146.74	44.98	1.16	0.171	0.560	0.5913	Complex (multi-dipole?) Mag signature
26	142.02	32.46	0.79	0.122	0.344	0.7648	Complex (multi-dipole?) Mag signature
27	146.23	88.00	0.15	0.081	0.183	0.9056	Multi-dipole Mag signature
28	164.97	65.91	0.60	0.071	0.148	0.8881	Very weak Mag
29	176.27	73.63	0.22	0.049	0.077	0.9210	Very weak Mag
30	174.70	82.36	0.24	0.052	0.085	0.7595	Weak Mag signature
31	185.96	77.42	0.00	0.093	0.226	0.9033	No Mag signature
32	225.42	63.88	0.00	0.065	0.127	0.6900	No Mag
33	279.03	95.11	0.28	0.174	0.572	0.9107	Can't fit Mag signature

Table 9. Continued

Target ID	Local X (m)	Local Y (m)	Depth (m)	Ferrous Size (m)	Non-Ferrous Size (m)	Fit Quality	Analyst Comments
34	220.10	104.82	0.00	0.039	0.051	0.8272	Small target (can't fit Mag)
35	161.53	98.94	0.00	0.032	0.036	0.9020	Small target, weak Mag
36	140.27	108.40	0.16	0.043	0.062	0.7678	No (or very weak) Mag signature
37	146.51	117.04	0.00	0.036	0.045	0.7071	Small target, very weak Mag
38	150.57	135.73	0.00	0.049	0.078	0.8565	trash, peculiar Mag signature
39	176.02	119.92	0.00	0.030	0.032	0.7548	Near-surface target, no Mag
40	181.38	137.02	0.21	0.051	0.084	0.8428	Weak Mag signature
41	164.34	127.37	0.00	0.028	0.029	0.7950	Near-surface, no Mag
42	172.06	132.76	0.00	0.047	0.073	0.9582	Near-surface, weak Mag
43	188.77	145.20	0.59	0.065	0.127	0.7526	Weak Mag
44	198.35	127.49	0.14	0.048	0.075	0.3973	Weak Mag
45	349.44	137.07	0.00	0.030	0.032	0.8515	Near-surface, peculiar Mag signature
46	332.48	149.44	0.28	0.038	0.050	0.8718	Very weak Mag
47	19.08	325.06	0.31	0.058	0.105	0.8448	Weak Mag
48	37.66	316.55	0.00	0.034	0.041	0.6551	Near-Surface target, no Mag
49	43.90	323.08	0.02	0.038	0.050	0.8498	extremely weak Mag
50	101.92	311.43	0.00	0.031	0.035	0.5189	can't fit Mag
51	81.44	334.84	0.00	0.039	0.051	0.7663	Near-surface target, no Mag
52	127.36	313.90	0.00	0.040	0.055	0.7876	Near-surface target, no Mag
53	136.69	305.16	0.00	0.027	0.027	0.7974	Near-surface target, no Mag
54	138.00	306.63	0.27	0.056	0.097	0.7705	Weak Mag
55	160.13	307.67	0.54	0.072	0.150	0.3821	Double-humped signature, weak Mag
56	181.65	306.28	0.00	0.030	0.031	0.7733	Near-surface target, no Mag
57	233.03	323.25	0.00	0.080	0.180	0.8827	Mag data shows wire nearby
58	207.80	265.76	0.00	0.031	0.034	0.8605	Near-surface, weak Mag
59	196.57	250.27	0.64	0.074	0.158	0.7448	Possibly between two weak Mag signals
60	195.19	286.92	0.04	0.038	0.049	0.8846	Weak Mag
61	153.43	249.36	0.70	0.090	0.215	0.7439	Weak Mag (two dipoles; one inverted)
62	85.29	242.00	0.50	0.061	0.113	0.8529	Weak Mag
63	154.19	232.43	0.65	0.090	0.216	0.8543	EM Targ, not in mag
64	153.71	193.57	0.00	0.045	0.067	0.8888	EM Targ
65	178.97	187.19	0.00	0.034	0.040	0.6146	EM Targ
66	150.33	109.59	0.00	0.062	0.116	0.9330	

Table 9. Continued

Target ID	Local X (m)	Local Y (m)	Depth (m)	Ferrous Size (m)	Non-Ferrous Size (m)	Fit Quality	Analyst Comments
67	177.49	108.22	0.00	0.035	0.043	0.8252	
68	32.10	241.55	0.00	0.021	0.019	0.7770	mag targ 291
69	34.53	246.39	0.42	0.095	0.234	0.8166	mag targ 290
70	23.43	243.70	0.09	0.052	0.087	0.9278	mag targ 292
71	14.43	279.86	0.00	0.067	0.132	0.9651	mag targ 293
72	31.45	279.87	0.27	0.130	0.379	0.9761	mag targ 295
73	52.98	298.23	0.00	0.039	0.052	0.7274	no mag signature, add to dig list
74	43.37	277.24	0.00	0.034	0.040	0.8824	mag targ 297
75	56.57	271.35	0.04	0.041	0.056	0.7395	mag targ 286
76	38.68	268.03	0.00	0.051	0.082	0.7249	mag targ 288
77	55.00	263.60	0.00	0.062	0.115	0.8647	mag targ 285
78	49.11	262.43	0.35	0.083	0.190	0.7795	not in mag add to dig list
79	67.70	260.75	0.00	0.098	0.247	0.9727	mag targ 283
80	64.87	247.42	0.00	0.036	0.046	0.9044	mag targ 282
81	70.41	249.15	0.37	0.062	0.116	0.6766	mag targ 281
82	85.99	265.94	0.11	0.075	0.161	0.8670	mag targ 271
83	82.33	250.41	0.10	0.067	0.134	0.9354	mag targ 277
84	86.32	251.89	0.17	0.079	0.173	0.9131	mag targ 276
85	88.14	239.51	0.00	0.035	0.043	0.8215	
86	86.21	256.18	0.00	0.053	0.088	0.8638	mag targ 275
87	82.51	293.68	0.00	0.038	0.050	0.8788	no mag targ, dig this
88	73.75	295.42	0.00	0.057	0.101	0.9569	mag targ 300
89	69.28	299.52	0.00	0.054	0.091	0.8916	mag targ 347
90	66.69	286.77	0.00	0.033	0.037	0.9479	mag targ 301
91	80.86	277.21	0.26	0.084	0.194	0.8375	mag targ 479
92	101.40	299.59	0.00	0.041	0.057	0.8189	mag targ 306
93	121.36	295.06	0.00	0.053	0.088	0.9132	not in mag, dog this
94	120.37	286.09	0.48	0.097	0.243	0.8786	mag targ 310
95	117.26	284.25	0.91	0.130	0.380	0.8704	mag targ 309
96	106.11	283.37	0.00	0.042	0.058	0.8363	mag targ 308
97	116.85	274.88	0.44	0.082	0.186	0.8974	not in mag, dig this
98	114.56	264.67	0.29	0.071	0.145	0.8695	mag targ 261
99	120.47	258.83	0.04	0.087	0.204	0.9582	mag targ 257

Table 9. Continued

Target ID	Local X (m)	Local Y (m)	Depth (m)	Ferrous Size (m)	Non-Ferrous Size (m)	Fit Quality	Analyst Comments
100	114.38	256.75	0.00	0.032	0.036	0.5861	mag targ 262
101	118.30	251.08	0.00	0.045	0.066	0.7665	mag targ 263
102	122.64	247.71	0.00	0.053	0.090	0.8593	mag targ 256
103	119.54	243.21	0.79	0.086	0.200	0.5285	mag targ 255
104	106.06	246.94	0.78	0.192	0.654	0.7821	mag targ 264
105	102.09	244.80	0.92	0.123	0.350	0.4424	mag targ 265
106	103.88	241.38	0.13	0.069	0.140	0.8646	mag targ 266
107	99.04	241.62	0.00	0.047	0.071	0.7542	mag targ 268
108	100.94	252.40	0.72	0.119	0.334	0.8275	mag targ 269
109	151.27	286.26	0.10	0.111	0.300	0.9131	mag targ 314
110	134.12	287.24	0.14	0.080	0.179	0.9110	mag targ 481
111	131.35	282.66	0.00	0.030	0.032	0.7515	mag targ 311
112	148.53	270.55	0.09	0.035	0.043	0.4872	mag targ 245
113	144.16	273.66	0.00	0.028	0.029	0.8581	mag targ 313
114	136.73	261.59	0.00	0.053	0.089	0.9591	not in mag list, dig this
115	131.67	260.22	0.27	0.066	0.129	0.7880	mag targ 258
116	145.51	262.81	0.10	0.121	0.341	0.9705	mag targ 246
117	147.49	256.09	0.00	0.038	0.049	0.7673	mag targ 247
118	140.47	252.26	0.70	0.090	0.214	0.7077	mag targ 248
119	143.63	250.47	0.00	0.064	0.122	0.8914	mag targ 249
120	137.46	242.23	0.00	0.053	0.091	0.8359	mag targ 253
121	155.10	242.35	0.00	0.062	0.116	0.7800	mag targ 242
122	164.92	244.33	0.00	0.036	0.045	0.9399	mag targ 241
123	166.60	260.65	0.00	0.043	0.062	0.9337	mag targ 238
124	175.40	262.09	0.04	0.041	0.058	0.9060	mag targ 237
125	179.07	256.28	0.00	0.075	0.161	0.9437	mag targ 236
126	166.64	279.21	0.01	0.063	0.121	0.9870	mag targ 316
127	163.84	282.68	0.00	0.050	0.080	0.9487	mag targ 317
128	183.73	279.54	0.17	0.055	0.095	0.8364	mag targ 319
129	177.75	295.57	0.01	0.077	0.169	0.9038	mag targ 318
130	163.84	291.73	0.00	0.043	0.062	0.9010	mag targ 475
131	163.19	295.01	0.00	0.084	0.192	0.9009	mag targ 474
132	206.57	285.91	0.00	0.042	0.059	0.9152	mag targ 320

Table 9. Continued

Target ID	Local X (m)	Local Y (m)	Depth (m)	Ferrous Size (m)	Non-Ferrous Size (m)	Fit Quality	Analyst Comments
133	235.17	298.84	0.00	0.023	0.021	0.4343	mag targ 328
134	227.22	278.90	0.16	0.055	0.095	0.8606	mag targ 322
135	226.24	238.92	0.00	0.050	0.080	0.8454	mag targ 228
136	265.87	262.76	0.00	0.023	0.020	0.6389	mag targ 234
137	267.30	268.93	0.24	0.062	0.118	0.8515	mag targ 233
138	284.63	254.20	0.00	0.049	0.078	0.5878	mag trarg 232
139	141.00	115.68	1.62	0.277	1.054	0.7985	mag targ 429
140	145.17	120.97	0.00	0.034	0.041	0.7338	mag targ 430
141	149.84	121.43	0.00	0.051	0.084	0.9107	mag targ 432
142	151.49	124.20	0.01	0.060	0.111	0.8375	mag targ 483
143	141.03	103.39	0.10	0.065	0.126	0.8075	mag targ 426
144	157.87	119.72	0.28	0.151	0.470	0.9933	mag targ 433
145	137.76	125.79	0.10	0.085	0.198	0.8954	mag targ 484
146	166.09	109.16	0.00	0.053	0.088	0.9031	mag targ 436
147	166.63	114.61	0.17	0.059	0.107	0.8830	mag targ 435
148	162.39	135.14	0.00	0.045	0.068	0.8914	mag targ 463
149	181.08	102.61	0.00	0.030	0.031	0.8460	mag targ 440
150	195.02	116.44	0.00	0.028	0.029	0.4150	mag targ 44
151	226.09	96.61	0.40	0.105	0.275	0.8865	mag targ 443
152	173.17	135.39	1.32	0.116	0.322	0.3941	mag targ 461
153	172.25	145.69	0.15	0.082	0.186	0.8903	mag targ 465
154	169.41	146.50	0.44	0.092	0.224	0.8918	mag targ 466
155	163.99	145.28	0.32	0.184	0.617	0.9898	mag targ 468
156	164.22	137.59	0.03	0.064	0.124	0.9643	mag targ 464
157	154.30	147.34	0.07	0.093	0.226	0.9713	mag targ 469
158	152.75	142.65	0.00	0.029	0.030	0.4255	mag targ 470
159	148.17	139.27	0.00	0.035	0.043	0.5693	mag targ 471
160	132.43	154.49	0.68	0.152	0.473	0.8257	mag targ 52
161	139.01	164.83	0.00	0.079	0.176	0.9011	mag targ 53
162	143.02	167.61	0.56	0.134	0.397	0.8607	mag targ 61
163	139.15	169.78	0.00	0.047	0.071	0.8400	mag targ 60
164	140.96	172.49	0.00	0.035	0.042	0.6439	mag targ 58
165	149.12	176.95	1.02	0.144	0.440	0.7328	mag targ 62

Table 9. Continued

Target ID	Local X (m)	Local Y (m)	Depth (m)	Ferrous Size (m)	Non-Ferrous Size (m)	Fit Quality	Analyst Comments
166	150.25	163.29	0.12	0.070	0.143	0.8241	mag targ 63
167	160.11	159.50	0.19	0.081	0.182	0.8509	mag targ 67
168	134.84	180.00	0.34	0.071	0.146	0.6070	mag targ 56
169	159.15	179.73	0.00	0.034	0.040	0.6666	mag targ 493
170	188.79	170.24	0.01	0.090	0.216	0.8949	mag targ 68
171	192.57	175.24	0.17	0.050	0.080	0.8171	mag targ 494
172	142.79	-26.55	0.54	0.083	0.190	0.5812	MAG Targ 363
173	189.79	-37.53	0.00	0.036	0.044	0.8171	MAG Targ 361
174	184.15	-17.64	0.00	0.035	0.042	0.7001	MAG Targ 367
175	329.53	-11.37	0.00	0.024	0.022	0.7639	MAG Targ 370
176	212.99	-5.77	0.82	0.098	0.247	0.8351	MAG Targ 368
177	213.52	-2.76	0.00	0.022	0.020	0.6387	MAG Targ 369
178	183.87	-14.43	1.24	0.159	0.505	0.7745	MAG Targ 366
179	167.14	-7.66	0.30	0.062	0.117	0.9192	MAG Targ 364
180	164.97	5.97	0.00	0.021	0.018	0.1567	NO Mag Signature, DIG THIS
181	160.60	13.38	0.68	0.080	0.179	0.7418	MAG Targ 378
182	141.60	2.78	0.38	0.056	0.098	0.6753	NO Mag Signature, DIG THIS
183	136.44	41.63	0.00	0.058	0.104	0.9492	Partial Signature, MAG TARG 382
184	145.92	35.49	0.58	0.127	0.365	0.9021	MAG Targ 381
185	143.45	22.74	0.16	0.048	0.075	0.8143	MAG Targ 380
186	144.14	17.91	0.60	0.093	0.226	0.6807	Weak mag signature, DIG THIS
187	151.02	27.39	0.19	0.057	0.102	0.9206	Mag Targ 379
188	154.71	27.00	0.00	0.054	0.092	0.9338	No Mag Signature, DIG THIS
189	157.89	33.82	0.63	0.080	0.177	0.5136	No Mag Signature, DIG THIS
190	176.52	28.26	0.20	0.045	0.068	0.7786	Mag Targ 377
191	214.10	25.16	0.00	0.037	0.048	0.9695	Mag Targ 374
192	226.43	42.74	0.37	0.101	0.257	0.7853	Mag Targ 387
193	288.51	18.48	0.00	0.067	0.132	0.9699	Mag Targ 372
194	325.64	71.64	0.00	0.034	0.040	0.8755	Mag Signature is very Wierd
195	225.30	46.33	0.00	0.097	0.242	0.8811	Large EM Targ. No mag sig. DIG THIS
196	188.32	59.79	0.24	0.148	0.455	0.8639	Mag Targ 386
197	170.63	72.36	0.00	0.032	0.036	0.5633	Mag Targ 403
198	160.44	71.37	0.00	0.057	0.100	0.9455	Mag Targ 404

Table 9. Continued

Target ID	Local X (m)	Local Y (m)	Depth (m)	Ferrous Size (m)	Non-Ferrous Size (m)	Fit Quality	Analyst Comments
199	153.22	68.32	0.32	0.170	0.556	0.9734	MAG TARGET 406
200	146.73	59.72	0.29	0.071	0.145	0.7449	MAG TARGET 384
201	141.44	47.55	0.73	0.144	0.441	0.8486	MAG TARGET 383
202	145.82	68.11	1.10	0.139	0.419	0.8218	MAG TARGET 413
203	142.54	69.91	0.00	0.046	0.069	0.6753	Small targ on surface
204	145.43	73.36	0.41	0.200	0.692	0.9529	MAG TARGET 414
205	155.15	74.37	0.40	0.215	0.763	0.9434	MAG TARGET 408
206	145.41	79.15	0.33	0.072	0.151	0.8171	MAG TARGET 416
207	143.08	80.84	0.00	0.054	0.093	0.9317	MAG TARGET 417
208	140.61	83.54	0.00	0.037	0.046	0.6494	MAG TARGET 420
209	137.44	85.86	0.00	0.058	0.103	0.8930	MAG TARGET 419
210	160.68	83.25	0.00	0.093	0.228	0.9631	MAG TARGET 409
211	160.14	90.87	0.00	0.046	0.069	0.8817	MAG TARGET 411
212	144.09	97.36	0.27	0.124	0.352	0.9716	MAG TARGET 423
213	141.03	103.39	0.10	0.065	0.126	0.7796	MAG TARGET 426
214	145.58	101.60	0.09	0.054	0.091	0.9112	MAG TARGET 427
215	220.39	90.69	0.00	0.033	0.037	0.7286	MAG TARGET 400
216	254.49	86.61	0.18	0.086	0.201	0.9382	MAG TARGET 397
217	282.31	100.54	0.00	0.095	0.234	0.9840	MAG TARGET 449
218	277.53	101.90	0.12	0.088	0.209	0.9548	MAG TARGET 448
219	271.17	97.92	0.00	0.029	0.030	0.3859	MAG TARGET 447
220	342.44	75.91	0.00	0.040	0.055	0.9754	MAG TARGET 393
221	327.64	84.46	0.00	0.032	0.035	0.8238	MAG TARGET 395
222	315.42	131.67	0.00	0.084	0.193	0.9428	
223	261.93	131.01	0.49	0.244	0.896	0.9510	MAG TARGET 456
224	164.65	106.36	0.00	0.042	0.058	0.8174	NO MAG SIGNATURE
225	237.83	134.08	0.00	0.030	0.032	0.5353	MAG TARGET 458
226	241.22	153.14	0.27	0.169	0.549	0.9252	MAG TARGET 473
227	295.56	145.66	0.00	0.048	0.075	0.8873	MAG TARG 455
228	293.43	147.21	0.49	0.240	0.879	0.9700	MAG TARGET 454
229	321.06	139.43	0.00	0.028	0.029	0.5132	Small targ on surface
230	330.37	142.73	0.56	0.274	1.036	0.9454	Mag targ 451
231	24.71	152.35	0.00	0.029	0.031	0.7303	not in mag, dig this

Table 9. Continued

Target ID	Local X (m)	Local Y (m)	Depth (m)	Ferrous Size (m)	Non-Ferrous Size (m)	Fit Quality	Analyst Comments
232	60.37	151.18	0.00	0.039	0.051	0.6248	not in mag, dig this
233	37.97	178.33	0.26	0.048	0.075	0.8888	not in mag, dig this
234	67.63	152.74	0.00	0.047	0.072	0.8162	not in mag, dig this
235	60.34	205.96	0.03	0.045	0.067	0.7223	not in mag, dig this
236	88.73	197.30	0.22	0.055	0.095	0.8328	not in mag, dig this
237	88.92	254.38	0.23	0.079	0.174	0.8757	not picked in mag, dig this
238	52.98	298.23	0.00	0.039	0.052	0.7483	no mag signature, dig this
239	83.28	300.19	0.00	0.037	0.048	0.7351	weak mag signature, dig this

Table 10. Targets Remediated at BBR I

Target ID	Fit Quality	Das Analyst Comments	Depth (m) Fit	Depth (m) Reported	Target Size Ordn. Fit	Target Size Ordn. Reported	Target Size Scrap Reported (in)	Azimuth Fit	Azimuth Reported	Miss Distance (m)	UXO Remediation Comments
BR1-077	0.968	Diameter of MK84, nose down, clutter 1m to SE	1.75	1.96	0.317	0.279		358	320	0.426	250 lb bomb
BR1-194	0.982	very large and deep, nose down	1.52	1.63	0.274	0.267		123	140	0.258	250 lb bomb
BR1-217	0.989	small target on surface	0.05	0.00	0.063		5.5 x 7	355	350	0.033	ordnance scrap
BR1-218	0.951	20mm?	0.06	0.04	0.033	0.095		8	8	0.142	M 38, spotting charge can
BR1-219	0.928	20mm?	0.08	0.04	0.025		2 x 4	327	320	0.015	M 38, spotting charge can
BR1-220	0.901	20mm?	0.09		0.026		6.5 x 2.5	30	40	0.005	M 38, spotting charge can
BR1-222	0.943	20mm?	0.04		0.025		2.25 x 3	6	10	0.302	ordnance scrap
BR1-254	0.970	trash on surface	0.02	0.00	0.053	0.216		16	40	0.226	paint can
BR1-255	0.973	good target	0.83	0.99	0.143	0.356		343	90	0.431	M 38, practice bomb
BR1-304	0.847	good target, with clutter 0.5 m to west	0.68	0.69	0.163	0.305		227	330	0.252	M 38, practice bomb
BR1-305	0.990	great target	0.66	0.69	0.167	0.279		42	30	0.024	M 38, practice bomb
BR1-314	0.975	small targ on surface	0.05	0.00	0.055	0.267		342	284	0.100	bomb fin
BR1-315	0.995	small targ on surface	0.05	0.00	0.051	0.216		3	0	0.082	ordnance scrap
BR1-316	0.989	small targ on surface	0.04	0.00	0.063	0.203		4	350	0.071	ordnance scrap
BR1-317	0.782	small targ on surface	0.02	0.00	0.084	0.292		330	240	0.213	coiled wire
BR1-324	0.848	small target on surface	0.05	0.00	0.071	0.197		3	80	0.143	bomb fin

Table 10. Continued

Target ID	Fit Quality	DAS Analyst Comments	Depth (m) Fit	Depth (m) Reported	Target Size Ordn. Fit	Target Size Ordn. Reported	Target Size Scrap Reported (in)	Azimuth Fit	Azimuth Reported	Miss Distance (m)	UXO Remediation Comments
BR1-325	0.978	great target	0.57	0.55	0.165	0.406		8	355	0.076	M 38, practice bomb
BR1-326	0.985	good target, clutter 1m north, trash to southwest	0.33	0.30	0.192	0.267		13	23	0.164	M 38, practice bomb
BR1-328	0.994	great target	0.98	0.99	0.173	0.343		8	320	0.138	M 38, practice bomb
BR1-329	0.970	small targ on surface	0.04	0.00	0.070	0.089		340	330	0.056	metal scrap
BR1-330	0.939		1.41	1.35	0.368	0.279		214		0.179	250 lb bomb
BR1-331	0.989	good target, nose down	0.24	0.20	0.180	0.279		16	300	0.045	distorted M 38
BR1-332	0.984	good target	0.64	0.58	0.197	0.229		345	315	0.243	M 38, practice bomb
BR1-333	0.966	good target	0.86	0.64	0.166	0.279		166	220	0.019	distorted M 38
BR1-334	0.951	good target	0.48	0.46	0.190	0.241		340	330	0.074	M 38, practice bomb
BR1-335	0.977	good target	0.51	0.41	0.176	0.356		23	10	0.098	M 38, practice bomb
BR1-347	0.889	small targ near surface	0.18	0.15	0.056		7.5 x 4.5	355	355	0.090	ordnance scrap
BR1-348	0.744	small targ near surface	0.11	0.00	0.053		7.5 x 6	329	320	0.102	ordnance scrap
BR1-350	0.922	surface clutter	0.04	0.00	0.055		8 x 4.25	8	355	0.106	ordnance scrap
BR1-351	0.969	small targ, medium depth	0.34		0.076			7			
BR1-352	0.870	chunk on surface	0.06	0.00	0.088		7 x 8	3	350	0.022	ordnance scrap
BR1-353	0.983	good target	0.60		0.169			5			

Table 10. Continued

Target ID	Fit Quality	DAS Analyst Comments	Depth (m) Fit	Depth (m) Reported	Target Size Ordn. Fit	Target Size Ordn. Reported	Target Size Scrap Reported (in)	Azimuth Fit	Azimuth Reported	Miss Distance (m)	UXO Remediation Comments
BR1-354	0.988	good target	0.76	0.56	0.149	0.279		51	10	0.014	distorted M 38
BR1-355	0.981	good target	0.30	0.25	0.178	0.254		335	310	0.074	M 38, practice bomb
BR1-356	0.984	small target, shallow	0.13	0.15	0.063		7 x 8	358		0.079	box fin
BR1-357	0.985	good target	0.87	0.74	0.146	0.330		357	80	0.049	M 38
BR1-359	0.977	good target, clutter targets above and to north	0.73	0.69	0.180	0.254		19	70	0.055	M 38 with burster tube
BR1-360	0.987	good target	0.74	0.71	0.163	0.483		5	0	0.038	collapsed M 38
BR1-361	0.957	good target	0.73	0.61	0.163	0.330		14	50	0.078	deteriorated M 38
BR1-362	0.993	good target	1.17	1.02	0.179	0.254		40	270	0.161	M 38
BR1-363	0.976	Diameter of MK82-84, nose down	2.55	2.44	0.319	0.267		2	180	0.089	250 lb bomb with conical fins
BR1-364	0.973	very shallow for size, may be 2 targets	0.13	0.00	0.144	0.076		311	290	0.152	250 lb bomb scrap
BR1-365	0.961	good target	0.28	0.23	0.185	0.229		357	255	0.020	M 38
BR1-367	0.954	too deep for this sized target, likely dry hole, DIG IT!	1.89		0.167			7			Dry Hole, dug to 7 ft.
BR1-368	0.990	good target	0.93	0.81	0.150	0.457		41	60	0.066	pancaked M 38
BR1-369	0.991	good target	0.55	0.56	0.179	0.432		342	160	0.134	M 38
BR1-370	0.961	good target	0.49	0.52	0.173	0.279		252		0.072	distorted M 38
BR1-371	0.978	large chunk on surface	0.15	0.00	0.117	0.057		50	40	0.034	ordnance scrap

Table 10. Continued

Target ID	Fit Quality	DAS Analyst Comments	Depth (m) Fit	Depth (m) Reported	Target Size Ordn. Fit	Target Size Ordn. Reported	Target Size Scrap Reported (in)	Azimuth Fit	Azimuth Reported	Miss Distance (m)	UXO Remediation Comments
BR1-372	0.989	good target	0.56	0.50	0.173	0.305		48	240	0.083	deteriorated M 38
BR1-373	0.889	good target, poor fit	0.17	0.18	0.134	0.406		312	74	0.036	M 38
BR1-374	0.919	trash on surface	0.00	0.00	0.078		9 X 7.5	343	320	0.464	metal scrap
BR1-375	0.954	small targ on surface	0.04	0.00	0.083		10.5 X 6.5	10	20	0.112	bomb fin
BR1-376	0.992	trash on surface	0.06	0.03	0.068		4 X 4.5	26	30	0.078	ordnance scrap
BR1-377	0.987	good target	0.95	0.84	0.157	0.406		328	330	0.140	broken up M 38
BR1-378	0.965	small targ, shallow	0.10	0.00	0.066	0.203		13		0.035	metal scrap
BR1-379	0.957	good target	0.83	0.62	0.129	0.330		78	260	0.130	M 38
BR1-380	0.676	multiple pieces of clutter	0.21		0.072			344			Dry Hole
BR1-382	0.758	trash on surface	0.00	0.00	0.065		6 X 7	360	350	0.210	bomb fin
BR1-385	0.974	good target, large clutter to southwest and north above	0.42	0.36	0.198	0.279		348	330	0.201	distorted M 38
BR1-386	0.979	paired with larger target to northwest	0.29	0.27	0.115	0.057		357	330	0.067	SCAR, folded
BR1-387	0.936	good target	0.85	0.66	0.210	0.254		28	310	0.265	M 38
BR1-392	0.994	good target, clutter to south	0.37	0.33	0.197	0.254		2	330	0.119	M 38
BR1-396	0.967	good target	0.63	0.79	0.179	0.330		54	270	0.070	M 38
BR1-397	0.949	good target, paired with one to east	0.70	0.67	0.156	0.241		35	320	0.136	M 38

Table 10. Continued

Target ID	Fit Quality	DAS Analyst Comments	Depth (m) Fit	Depth (m) Reported	Target Size Ordn. Fit	Target Size Ordn. Reported	Target Size Scrap Reported (in)	Azimuth Fit	Azimuth Reported	Miss Distance (m)	UXO Remediation Comments
BR1-398	0.967	good target paired with one to the west	0.60	0.46	0.173	0.356		316	300	0.638	distorted M 38
BR1-399	0.988	good target	0.45	0.53	0.157	0.216		356	40	0.065	M 38
BR1-402	0.944	small targ on surface	0.04	0.00	0.037	0.152		31	25	0.439	bomb fin
BR1-403	0.971	small targ on surface	0.00	0.00	0.058	0.298		326	332	0.312	bomb fin
BR1-404	0.865	small targ on surface	0.00	0.00	0.046	0.165		353	22	0.084	bomb fin
BR1-405	0.972	good target	0.45	0.56	0.158	0.419		355	300	0.075	M 38
BR1-406	0.993	small target on surface	0.04	0.04	0.044	0.171		359	8	0.166	bomb fin
BR1-407	0.946	medium sized target, good fit	0.37		0.134			19			Dry Hole
BR1-408	0.926	small targ on surface	0.06	0.01	0.064	0.178		30		0.012	bomb fin
BR1-409	0.991	good target	0.47	0.47	0.158	0.502		355		0.223	M 38
BR1-410	0.965	medium sized target, god fit	0.22		0.125			17			Dry Hole
BR1-411	0.950	fairly deep, low probability fit	1.81		0.156			25			Dry Hole, dug to 5 ft.
BR1-412	0.995	excellent target, shallow	0.34	0.53	0.202	0.305		10	252	0.089	Dig Sheet used to correct TDC record
BR1-413	0.968	small target, shallow	0.11	0.00	0.080	0.254		21	30	0.060	distorted M 38
BR1-414	0.986	good target, shallow	0.58	0.50	0.140	0.572		25	90	0.083	bomb fin
BR1-415	0.987	excellent target	0.67	0.66	0.158	0.356		15	120	0.180	M 38 deteriorated

Table 10. Continued

Target ID	Fit Quality	DAS Analyst Comments	Depth (m) Fit	Depth (m) Reported	Target Size Ordn. Fit	Target Size Ordn. Reported	Target Size Scrap Reported (in)	Azimuth Fit	Azimuth Reported	Miss Distance (m)	UXO Remediation Comments
BR1-416	0.959	small targ on surface	0.04	0.00	0.050	0.203		17		0.051	ordnance scrap
BR1-417	0.995	small target, on surface	0.06	0.00	0.060	0.089		17	210	0.071	M 38, fuse & burster assembly
BR1-418	0.893	surface clutter 1m northeast and 2m southwest	0.71	0.66	0.183	0.203		343	300	0.300	M 38
BR1-419	0.986	good target	0.95	0.91	0.163		16 X 11	1		0.484	crushed M 38
BR1-420	0.922	small target near surface, clutter north and east	0.08	0.00	0.069	0.057		97	260	0.049	SCAR, bent
BR1-421	0.967	good target	0.66	0.64	0.172	0.279		61	270	0.108	distorted M 38
BR1-422	0.983	good target with clutter target 1.5m to southeast	0.36	0.34	0.144	0.330		358	315	0.063	M 38
BR1-423	0.940	good target, very shallow	0.15	0.00	0.150	0.057		297	286	0.042	SCAR on surface
BR1-424	0.936	imposible signal, big & deep, must dig	3.43		0.305			152			Dry Hole, dug to 11 ft.
BR1-425	0.988	excellent target	0.68	0.42	0.159	0.457		354	10	0.060	pancaked M 38
BR1-426	0.940	good target with clutter target 1.5m south	1.03	0.69	0.194	0.267		153		0.094	compressed M 38
BR1-427	0.959	large target, nose down & shallow	0.61	0.58	0.237	0.235		358	55	0.094	M 38, good condition
BR1-428	0.979	good target, nose down	0.90	0.79	0.156	0.406		284	350	0.122	distorted M 38
BR1-429	0.960	good target	0.96	0.99	0.161	0.254		314	280	0.029	distorted M 38
BR1-431	0.974	small target at 0.6m	0.57		0.057			324			Dry Hole, dug to 2 ft.
BR1-432	0.991	good target	0.74	0.74	0.164	0.330		344	0	0.025	M 38 deteriorated

Table 10. Continued

Target ID	Fit Quality	DAS Analyst Comments	Depth (m) Fit	Depth (m) Reported	Target Size Ordn. Fit	Target Size Ordn. Reported	Target Size Scrap Reported (in)	Azimuth Fit	Azimuth Reported	Miss Distance (m)	UXO Remediation Comments
BR1-433	0.903	low probability fit, inverted signature	1.19		0.091			89			Dry Hole, dug to 4 ft.
BR1-434	0.988	good target, very shallow	0.41	0.30	0.197	0.229		340	315	0.095	M 38, good condition
BR1-435	0.976	small target on surface	0.06	0.00	0.066			356		0.496	ordnance scrap
BR1-436	0.945	very deep, medium fit, inverted signature	2.74		0.263			110			Dry Hole, dug to 8 ft.
BR1-437	0.910	small target medium deep	0.68		0.091			15			Dry Hole, dug to 3 ft.
BR1-438	0.986	good target	0.42	0.32	0.217	0.292		175	295	0.087	M 38, live spotting charge
BR1-439	0.928	two shallow targets 0.5m apart	0.07	0.00	0.116	0.330		21		0.044	M 38
BR1-440	0.949	good target	0.46	0.33	0.154	0.305		31	350	0.035	M 38, distorted
BR1-441	0.975	good target, nose down	0.76	0.74	0.153	0.356		81	80	0.198	M 38, deterioriated
BR1-442	0.937	medium sized target, shallow	0.29	0.41	0.145	0.381		12	355	0.033	M 38 with arming wire
BR1-443	0.992	good target, shallow	0.35	0.25	0.181	0.229		0	315	0.106	M 38
BR1-444	0.985	good target	0.30	0.35	0.142	0.406		113	24	0.184	M 38, pancaked
BR1-445	0.993	excellent target	0.51	0.61	0.146	0.445		8	32	0.135	M 38, pancaked
BR1-446	0.982	excellent target	0.75	0.74	0.153	0.457		300	360	0.053	M 38, pancaked
BR1-447	0.987	excellent target	0.70	0.71	0.159	0.457		222	180	0.242	M 38, pancaked
BR1-448	0.885	surface trash	0.01	0.00	0.072	0.241		352	328	0.148	bomb fin

Table 10. Continued

Target ID	Fit Quality	DAS Analyst Comments	Depth (m) Fit	Depth (m) Reported	Target Size Ordn. Fit	Target Size Ordn. Reported	Target Size Scrap Reported (in)	Azimuth Fit	Azimuth Reported	Miss Distance (m)	UXO Remediation Comments
BR1-449	0.954	small target on surface	0.03	0.00	0.090		11 X 8.5	3	0	0.080	box fin
BR1-450	0.862	surface trash	0.00	0.00	0.089		7.5 X 6.5	22	11	0.266	ordnance scrap
BR1-451	0.987	small target near surface	0.07	0.00	0.091	#VALUE!		26	13	0.100	ordnance scrap
BR1-452	0.981	good target	0.40	0.36	0.175	0.330		177	177	0.054	distorted M 38
BR1-453	0.966	good target, tail fins? on surface 1m to southwest	0.52	0.67	0.181	0.394		302	313	0.069	M 38
BR1-454	0.996	good target	0.41	0.25	0.174	0.254		4	23	0.030	M 38
BR1-455	0.979	good target	1.01	0.98	0.179			0	0	0.158	M 38
BR1-456	0.977	good target	0.50	0.56	0.137	0.279		9	65	0.041	deteriorated M 38
BR1-457	0.950	good target with surface clutter 1m northeast	0.86	0.81	0.152	0.305		137	230	0.133	pancaked M 38
BR1-458	0.981	good target	0.55	0.57	0.145	0.330		338	140	0.148	distorted M 38
BR1-459	0.982	good target	0.44	0.36	0.161	0.356		173		0.148	pancaked M 38
BR1-460	0.909	very big, very deep, inverted dipole, should dig	3.49		0.340			253			Dry Hole, dug to 12 ft
BR1-461	0.913	big and deep, medium fit	2.46		0.253			305			Dry Hole, dug to 9 ft.
BR1-462	0.973	good target, very shallow	0.15	0.05	0.158	0.292		46	280	0.050	M 38, distorted
BR1-464	0.981	good target, surface clutter 1m southeast	0.87	0.71	0.156	0.533		356		0.034	broken up M 38
BR1-468	0.925	small target on the surface	0.02	0.00	0.052		7 X 9	35		0.069	bomb fin

Table 10. Continued

Target ID	Fit Quality	DAS Analyst Comments	Depth (m) Fit	Depth (m) Reported	Target Size Ordn. Fit	Target Size Ordn. Reported	Target Size Scrap Reported (in)	Azimuth Fit	Azimuth Reported	Miss Distance (m)	UXO Remediation Comments
BR1-470	0.975	small target near surface	0.07	0.01	0.047		8 X 4	47		0.157	ordnance scrap
BR1-472	0.977	small target, near surface	0.08	0.00	0.057		10 X 6	350		0.236	bomb fin
BR1-475	0.969	small target near surface	0.07	0.03	0.048	0.152	5 X 6	21	330	0.225	bomb fin
BR1-476	0.776	small target, very deep, weak fit	1.34		0.098			38			Dry Hole
BR1-478	0.921	small target on surface	0.00	0.03	0.050		8 X 7	355	360	0.092	bomb fin
BR1-479	0.982	small target on the surface	0.01	0.00	0.059		8.5 X 6	4	360	0.170	ordnance scrap
BR1-480	0.951	small target, near surface	0.13	0.00	0.058		7 X 5.5	26	14	0.098	ordnance scrap
BR1-481	0.945	small target near the surface	0.17	0.04	0.065	0.006	14 X 2	0	352	0.046	flat metal scrap
BR1-483	0.973	small target on the surface	0.06	0.00	0.050		4.5 X 6.25	21	251	0.020	box fin
BR1-484	0.985	small target near the surface, won't fit	0.09	0.00	0.063		6.5 X 7.5	7	253	0.017	box fin
BR1-485	0.873	small target on surface, second target 1m to SW	0.06	0.00	0.055		15 X 10.5	358	60	0.183	ordnance scrap
BR1-E100	0.804	not in mag, surface scrap	0.00	0.00	0.037	0.006				0.037	fence wire
BR1-E117	0.912	not in mag, surface clutter	0.03	0.00	0.069		8.5 X 7		120	0.155	bomb fin
BR1-E119	0.907	not in mag, shallow target, medium sized	0.20	0.00	0.155		15 X 9		30	0.798	tractor exhaust
BR1-E125	0.820	not in mag, small targ on surface	0.00	0.01	0.037	0.076			270	0.047	2.75" W.H. scrap

Table 10. Continued

Target ID	Fit Quality	DAS Analyst Comments	Depth (m) Fit	Depth (m) Reported	Target Size Ordn. Fit	Target Size Ordn. Reported	Target Size Scrap Reported (in)	Azimuth Fit	Azimuth Reported	Miss Distance (m)	UXO Remediation Comments
BR1-E131	0.850	not in mag, small target near surface	0.00	6.86	0.037		8 X 6.5			0.103	SCAR fin
BR1-E132	0.769	not in mag cluster of clutter on surface	0.00	0.00	0.029	0.356					bomb fim

Table 11. Targets Remediated at BBR Target 2.

Target ID	Fit Quality	DAS Analyst Comments	Depth (m) Fit	Depth (m) Reported	Target Size Ordn. Fit	Target Size Ordn. Reported	Target Size Scrap Reported (in)	Azimuth Fit	Azimuth Reported	Miss Distance (m)	UXO Remediation Comments
BR3-001	0.989	small target, shallow, good fit	0.17	0.13	0.049	0.003		354		0.074	10" of wire
BR3-002	0.995	small target, shallow, good fit	0.17	0.08	0.045		5.5 X 2.5	352		0.047	SCAR Fin
BR3-004	0.916	small target at 1/4m	0.22	0.15	0.038		3.25 X 2.25	356		0.021	SCAR Fin
BR3-006	0.996	small target near surface	0.09	0.10	0.052		6.25 X 4.25	335		0.073	SCAR Fin
BR3-007	0.987	very small target at 1/4m	0.27	0.25	0.042	0.102		42		0.023	Venturi Section 2.75" Rocket
BR3-009	0.982	small target on surface	0.06	0.03	0.056		4.5 X 4.5	326		0.029	SCAR Fin
BR3-012	0.974	very small target	0.10	0.10	0.039		4 X 3.5	341		0.035	2.75" Rocket W.H.
BR3-013	0.987	very small target	0.06	0.03	0.035		4.5 X 2.75	337		0.062	SCAR Fin
BR3-014	0.924	very small target	0.16	0.23	0.037	0.070		357		0.022	Venturi, 2.75" Rocket
BR3-015	0.986	good target, clutter above to northeast, shallow for M38	0.10	0.00	0.147	0.057		320	350	0.148	SCAR, folded
BR3-016	0.910	medium target, very shallow	0.13	0.05	0.105		8.25 X 11	348		0.064	Fins from M38
BR3-017	0.958	small target near the surface	0.08	0.08	0.048		2.5 X 5	304		0.036	SCAR Fin, folded
BR3-018	0.978	medium sized target, mashed M38	0.39	0.42	0.121	0.057		314	315	0.052	SCAR, folded
BR3-019	0.980	small target near the surface	0.06	0.03	0.056		6 X 5.25	347		0.064	M38 Spotting Change cup, Smashed
BR3-020	0.974	medium target at 1/4m	0.26	0.15	0.059		5 X 3	2		0.042	M38 Fin
BR3-021	0.947	medium target, near surface	0.06	0.04	0.086	0.057		336	30	0.107	SCAR, folded
BR3-022	0.965	small target on surface	0.06	0.03	0.050		5.25 X 3.125	339		0.030	SCAR Fin

Table 11. Continued

Target ID	Fit Quality	DAS Analyst Comments	Depth (m) Fit	Depth (m) Reported	Target Size Ordn. Fit	Target Size Ordn. Reported	Target Size Scrap Reported (in)	Azimuth Fit	Azimuth Reported	Miss Distance (m)	UXO Remediation Comments
BR3-023	0.991	M38 (?)	0.48	0.55	0.180	0.057		320	300	0.072	SCAR with Fin
BR3-025	0.995	practice bomb? with clutter to west, north, and east	0.33	0.34	0.220	0.330		320	20	0.106	M 38
BR3-026	0.984	small target near surface	0.10	0.05	0.069		7 X5	314		0.046	2.75" W.H. Scrap
BR3-027	0.977	large target on surface	0.05	0.05	0.117	0.022		316	3.5	0.102	Metal Scrap
BR3-028	0.987	large target (M38?) clutter to south, southeast and east	0.66	0.61	0.260	0.057		0	355	0.080	SCAR, intact
BR3-029	0.938	good target, M38	0.37	0.30	0.141	0.057		355	355	0.062	SCAR with fin piece
BR3-032	0.973	large target, pretty shallow, likely tail fins on east edge	0.53	0.34	0.246	0.057		355	165	0.263	SCAR, intact with fin
BR3-033	0.983	good target with large clutter target 1m west	0.39	0.29	0.203	0.057		359	350	0.013	SCAR, intact, no fin
BR3-035	0.988	medium target on surface	0.06	0.03	0.101		9.5 X 1.25	300	300	0.017	Metal Strap
BR3-036	0.973	medium target, mashed M38	0.28	0.30	0.129	0.057		6	0	0.206	SCAR, mashed
BR3-037	0.982	large target, fairly deep, god fit, clutter 1.5m west, M38?	0.99	1.00	0.238	0.057		354	350	0.127	SCAR, intact
BR3-046	0.937	very large target, shallow, clutter above to northwest, dig this	0.43	0.46	0.301	0.229		311	340	0.191	M38 + SCAR
BR3-052	0.967	strong target, with inverted signal, practice bomb	0.31	0.20	0.137	0.057		191	0/0	0.017	SCAR, intact
BR3-053	0.959	strong target on surface with inverted signal, M38?	0.11	0.03	0.173	0.533		238		0.053	M38 cased strap
BR3-055	0.856	inverted signal, surface item	0.08	0.00	0.077		7 X 5	271		0.085	M38 scrap + SCAR fin
BR3-056	0.919	small target on surface	0.00	0.00	0.068			7		0.201	barbed wire

Table 11. Continued

Target ID	Fit Quality	DAS Analyst Comments	Depth (m) Fit	Depth (m) Reported	Target Size Ordn. Fit	Target Size Ordn. Reported	Target Size Scrap Reported (in)	Azimuth Fit	Azimuth Reported	Miss Distance (m)	UXO Remediation Comments
BR3-058	0.836	inverted signal, small targ, maybe several items	0.03	0.01	0.063			286		0.026	M 38 fins
BR3-059	0.996	inverted signal, medium target, shallow	0.18	0.03	0.119			245		0.129	3 metal straps
BR3-060	0.979	inverted signal, surface target	0.07	0.00	0.090		9 X 7	223		0.045	M 38 scrap and fin
BR3-061	0.923	inverted signal, surface, likely 2 targets side by side	0.03	0.03	0.083		9 X 8	246		0.149	2 M 38 fins
BR3-062	0.933	inverted signal, second target 1m north	0.24	0.05	0.093	0.019		243	70	0.125	M 38 burster tube + fin
BR3-063	0.992	small targ, inverted signal, EM sees signal at 1.5m NE	0.04	0.00	0.064			251		0.072	metal strap
BR3-066	0.994	surface target, inverted signal, no EM signal	0.06	0.03	0.073		8 X 2.5	242	250	0.027	M 38 case scrap
BR3-067	0.993	surface target, inverted signal, clutter to east and NE	0.03	0.00	0.064	0.057		260	60	0.065	SCAR venturi
BR3-068	0.970	large target on surface, inverted signal	0.13	0.00	0.130	0.057		204	40	0.082	SCAR
BR3-084	0.809	surface target, inverted signal	0.04	0.01	0.042		7 X 7.5	182	340	0.045	M 38 Fin
BR3-085	0.996	large target, inverted signal	0.43	0.48	0.212	0.279		191	15	0.083	M 38, armed
BR3-086	0.957	large target, inverted signal	0.62	0.56	0.233	0.203		195	30	0.118	M 38, deformed
BR3-087	0.865	small target near surface, inverted signal	0.12	0.05	0.078		9.5 X 5.5	193		0.038	M38, case scrap
BR3-088	0.982	medium target on surface, inverted signal	0.08	0.05	0.105		7 X 10.5	165		0.016	M 38 case scrap
BR3-089	0.991	medium target on surface, inverted signal	0.02	0.00	0.102		6 X 9	154		0.085	M38 scrap + venturi
BR3-090	0.976	large target, inverted signal	0.40	0.46	0.243	0.305		158	350	0.137	M 38, deformed

Table 11. Continued

Target ID	Fit Quality	DAS Analyst Comments	Depth (m) Fit	Depth (m) Reported	Target Size Ordn. Fit	Target Size Ordn. Reported	Target Size Scrap Reported (in)	Azimuth Fit	Azimuth Reported	Miss Distance (m)	UXO Remediation Comments
BR3-091	0.934	surface target, inverted signal	0.07	0.00	0.112		5 X 8	216		0.165	M 38 fin
BR3-093	0.991	surface target	0.07	0.04	0.071		6.5 X 5	142		0.035	M 38 fin
BR3-105	0.973	large target with clutter all around, 250lb bomb?	0.56	0.43	0.304	0.057		2	280	0.194	SCAR
BR3-109	0.957	surface target, inverted signal	0.13	0.00	0.126	0.014		276	250	0.144	steel spike (21")
BR3-113	0.981	surface target	0.10	0.06	0.096	0.071		45	200	0.047	SCAR scrap
BR3-117	0.935	large surface target	0.04	0.00	0.130		12.5 X 6.5	339		0.144	M 38 fins
BR3-133	0.987	surface target	0.05	0.00	0.098		9.5 X 3	8		0.089	M 38 case scrap
BR3-134	0.853	surface target	0.08	0.00	0.097		9.5 X 10	8		0.010	M 38 case scrap
BR3-158	0.931	too shallow for an M38	0.07	0.00	0.129	0.057		23	0	0.033	SCAR, crushed
BR3-160	0.988	good target , M38	0.42	0.46	0.232	0.057		16	15	0.132	SCAR
BR3-164	0.997	nearby clutter, M38	0.39	0.38	0.247	0.343		21	0	0.060	M 38, nearly spherical
BR3-170	0.991	nearby clutter, inverted signal, shallow for M38	0.28	0.22	0.163	0.057		72	235	0.022	SCAR
BR3-175	0.980	large and shallow	0.14	0.00	0.113		8.5 X 8	57		0.029	M 38 fin
BR3-177	0.950	medium target on surface	0.07	0.05	0.104	0.057		83	90	0.015	SCAR scrap
BR3-194	0.988	inverted signal	0.14	0.04	0.098	0.011		90	255	0.024	M38 burster tube with spotting change
BR3-202	0.983		0.07	0.03	0.066		5 X 2.5	120		0.084	M 38 fin

Table 11. Continued

Target ID	Fit Quality	DAS Analyst Comments	Depth (m) Fit	Depth (m) Reported	Target Size Ordn. Fit	Target Size Ordn. Reported	Target Size Scrap Reported (in)	Azimuth Fit	Azimuth Reported	Miss Distance (m)	UXO Remediation Comments
BR3-203	0.990		0.09	0.05	0.044		1.75 X 3.5	147		0.047	M 38 fin
BR3-204	0.834	poor fit	0.20	0.03	0.055		16 X 2	127		0.254	M 38 scrap peices
BR3-205	0.992		0.30	0.41	0.222	0.279		142	175	0.069	M 38
BR3-209	0.984		0.68	0.61	0.247	0.254		125	200	0.041	M 38
BR3-210	0.948		0.10	0.05	0.097		9 X 7.5	113	250	0.130	M 38 Fin
BR3-212	0.987		0.44	0.38	0.251	0.254		151		0.118	M 38, deformed
BR3-216	0.768	poor fit	0.08	0.00	0.050		9 X .125	126	110	0.016	10" steel wire
BR3-217	0.979	poor fit	0.02	0.01	0.057	0.019		186	180	0.012	M 38 bunster tube
BR3-223	0.996		0.60	0.58	0.205	0.356		169	280	0.070	M 38
BR3-224	0.976		0.06	0.03	0.032		1 X 1.25	115		0.085	7" wire + Al scrap
BR3-225	0.898		0.05	0.00	0.044		10 X 9	354		0.092	M 38 fin
BR3-232	0.993		0.08	0.05	0.054	0.070		25	30	0.047	2.75" W.H. intact
BR3-233	0.909		0.11	0.03	0.035		4 X 2.25	18	30	0.019	M38 fin
BR3-234	0.980		0.08	0.04	0.027		6 X 2.5	37	50	0.093	2.75" W.H. scrap
BR3-236	0.925	Small for bomb	0.14	0.00	0.122	0.057		48	219	0.071	SCAR, deformed
BR3-237	0.990		0.05	0.00	0.034	0.108		103		0.059	M 38 spotting change cover

Table 11. Continued

Target ID	Fit Quality	DAS Analyst Comments	Depth (m) Fit	Depth (m) Reported	Target Size Ordn. Fit	Target Size Ordn. Reported	Target Size Scrap Reported (in)	Azimuth Fit	Azimuth Reported	Miss Distance (m)	UXO Remediation Comments
BR3-238	0.855	poor fit, strong EM target	0.16	0.05	0.049		4.5 X 4	252	200	0.082	SCAR scrap
BR3-241	0.990	inverted signature	0.06	0.03	0.043		5 X 5	101	100	0.029	M 38 fin
BR3-242	0.964	complex EM signature	0.09	0.00	0.068		8.5 X 11	58	5	0.038	M 38 scrap piece
BR3-244	0.987		0.04	0.03	0.036	0.206		357		0.030	10" wire
BR3-245	0.985	fuzzy image	0.40		0.055			122		0.011	SCAR scrap/frag
BR3-246	0.990		0.31	0.30	0.207	0.381		89	15	0.037	M 38, deformed
BR3-247	0.944		0.08	0.00	0.056		9 X 8	31		0.052	M 38 scrap piece
BR3-248	0.927	inverted signature	0.08	0.06	0.047	0.025		117	110	0.028	6" metal scrap
BR3-249	0.902	inverted signature	0.07	0.00	0.089		7 X 7.25	109	190	0.361	M 38, fin
BR3-251	0.991		0.04	0.01	0.040	0.165		69		0.130	twisted wire
BR3-252	0.982		0.03	0.02	0.031		5.25 X 4.5	121		0.110	twisted wire
BR3-253	0.923	inverted signature, complex EM target	0.08	0.03	0.084	0.216		111		0.028	ordnance scrap
BR3-254	0.921	likely a squashed bomb	0.30	0.00	0.138	1.029		6		0.127	40" long twisted wire
BR3-255	0.990		0.06	0.00	0.092		8.625 X 7.75	92	90	0.009	About 30" of twisted wire
BR3-256	0.984	probably not a bomb	0.06	0.03	0.120	0.057		90	95	0.093	SCAR, deformed
BR3-257	0.972	clutter 1m south	0.08	0.08	0.086	0.057		92	35	0.037	SCAR, deformed

Table 11. Continued

Target ID	Fit Quality	DAS Analyst Comments	Depth (m) Fit	Depth (m) Reported	Target Size Ordn. Fit	Target Size Ordn. Reported	Target Size Scrap Reported (in)	Azimuth Fit	Azimuth Reported	Miss Distance (m)	UXO Remediation Comments
BR3-258	0.992		0.15	0.10	0.079		9 X 1.75	76	75	0.022	metal scrap, 9"
BR3-259	0.997		0.06		0.066			45			Dry Hole, cows moved flag
BR3-260	0.947		0.07		0.063			71			Dry Hole, cows moved flag
BR3-261	0.967		0.39	0.13	0.068	0.095		78	60	0.034	M 38 spotting change can
BR3-262	0.971		0.03	0.00	0.073		7.25 X 9.125	68	70	0.129	ordnance scrap
BR3-264	0.932	probably is a bomb	0.13	0.03	0.134	0.057		59	60	0.081	SCAR
BR3-265	0.995		0.06	0.03	0.105		11.5 X 1.25	87	85	0.128	ordnance frag
BR3-266	0.988		0.07	0.05	0.063	0.057		346	345	0.065	SCAR, low order burst
BR3-267	0.997		0.00	0.00	0.087		8 X 5.75	64		0.049	ordnance scrap
BR3-268	0.884	may not be a bomb, weak EM signature	0.47	0.08	0.162	0.013		68	90	0.247	0.5" diam cable 50"long
BR3-269	0.978		0.34	0.28	0.072		7 X 4.25	76	75	0.066	ordnance scrap with frag
BR3-270	0.943		0.04		0.057	0.248		82	87	0.026	ordnance scrap
BR3-271	0.969	surface target	0.05	0.00	0.064		7 X 8.5	7	10	0.063	ordnance scrap
BR3-273	0.970	2m north of bomb	0.07	0.03	0.077		6.75 X 5	18	10	0.079	ordnance scrap
BR3-275	0.929	surface target	0.05	0.00	0.058		10.25 X 5	53	75	0.034	ordnance scrap
BR3-276	0.949		0.06	0.03	0.074		7 X 8.25	41	60	0.1	M 38 fins

Table 11. Continued

Target ID	Fit Quality	DAS Analyst Comments	Depth (m)		Target Size			Azimuth		Miss Distance (m)	UXO Remediation Comments
			Fit	Reported	Ordn. Fit	Ordn. Reported	Scrap Reported (in)	Fit	Reported		
BR3-277	0.936	surface target	0.06	0.00	0.065		7.5 X 7	36	50	0.008	ordnance scrap
BR3-278	0.995	surface target	0.06	0.00	0.073	0.235		64	320	0.043	10" long twisted wire
BR3-279	0.977	fuzzy image	0.07	0.03	0.049	0.003		35	50	0.017	7" of wire
BR3-281	0.975	surface target	0.09	0.03	0.057		9.75 X 7.5	91	100	0.056	metal scrap (ord)
BR3-282	0.929	medium target on surface	0.09	0.04	0.100		10.25 X 4.25	72	70	0.045	metal scrap (ord)
BR3-283	0.919	very large target on surface, strong EM, 2.75?	0.17	0.10	0.185			30		0.216	M 38 tail cone & fins; several pieces
BR3-285	0.971	very large target on surface, strong EM, 2.75?	0.08	0.05	0.158	0.057		55	40	0.100	SCAR
BR3-286	0.985	good EM target also	0.03	0.03	0.042		5 X 4.75	53	40	0.101	ordnance scrap
BR3-287	0.979	small target near surface	0.18	0.15	0.056		6 X 14	53	65	0.022	20" twisted wire
BR3-288	0.983	medium target on surface	0.06	0.05	0.108	0.114		64	70	0.057	SCAR, deformed
BR3-289	0.990	surface target	0.04	0.00	0.038	0.146		21	50	0.029	Tail fin
BR3-290	0.991	surface target	0.06	0.04	0.079		9.75 X 3.75	24	25	0.067	ordnance scrap
BR3-291	0.942	surface target	0.08	0.03	0.063		5 X 5.5	34	40	0.053	ordnance scrap
BR3-292	0.926	poor Mag, but good EM target	0.32	0.29	0.063		2 X 5.75	60	55	0.099	ordnance scrap
BR3-293	0.978	large target on the surface, clutter to the SE	0.07	0.08	0.120	0.057		22	10	0.112	SCAR scrap
BR3-294	0.961	maybe scrap with target 293	0.32	0.22	0.045	0.070		14	5	0.116	2.75" rocket venturi

Table 11. Continued

Target ID	Fit Quality	DAS Analyst Comments	Depth (m) Fit	Depth (m) Reported	Target Size Ordn. Fit	Target Size Ordn. Reported	Target Size Scrap Reported (in)	Azimuth Fit	Azimuth Reported	Miss Distance (m)	UXO Remediation Comments
BR3-295	0.965	M38	0.34	0.29	0.161	0.330		26	10	0.050	M 38 case scrap
BR3-296	0.976		0.08	0.05	0.040	0.003		348	340	0.069	10" of wire
BR3-297	0.982		0.04	0.04	0.042	0.133		340	340	0.104	ordnance scrap
BR3-300	0.959	mashed M38	0.09	0.05	0.125	0.070		2	355	0.047	SCAR
BR3-301	0.962	strong EM signature	0.06	0.05	0.037	0.089		18	30	0.009	spotting charge can, M 38
BR3-302	0.972		0.05	0.03	0.045	0.152		347	335	0.079	ordnance scrap
BR3-304	0.418	poor EM target	0.17	0.23	0.099			26	60	0.226	ordnance scrap, several pieces
BR3-305	0.944	strong EM target	0.03	0.03	0.035	0.108		29	30	0.052	spotting charge can, M 38
BR3-306	0.983		0.02	0.00	0.053		7 X 8.5	8	10	0.027	ordnance scrap
BR3-308	0.943		0.04	0.03	0.038	0.108		36	25	0.022	spotting charge can, M 38
BR3-309	0.949	good EM signature	0.32	0.28	0.070		6 X 5.25	47	52	0.056	ordnance scrap
BR3-310	0.947	good EM signature	0.26	0.18	0.075		8 X 5.5	72	70	0.106	ordnance scrap
BR3-311	0.987		0.06	0.03	0.037		3 X 5.75	37	25	0.019	ordnance scrap
BR3-312	0.981		0.22	0.03	0.052		3.5 X 4.5	103	85	0.143	M38 bunster + scrap
BR3-313	0.988		0.01	0.00	0.036		5.75 X 6.75	12	10	0.061	ordnance scrap
BR3-316	0.994	inverted signature	0.08	0.00	0.063		7.5 X 8.5	72		0.023	M 38 fin

Table 11. Continued

Target ID	Fit Quality	DAS Analyst Comments	Depth (m) Fit	Depth (m) Reported	Target Size Ordn. Fit	Target Size Ordn. Reported	Target Size Scrap Reported (in)	Azimuth Fit	Azimuth Reported	Miss Distance (m)	UXO Remediation Comments
BR3-317	0.916		0.07	0.05	0.049		2.5 X 6	32	40	0.064	2.75" W.H. scrap
BR3-318	0.976	complex EM signature	0.03	0.00	0.071		11.5 X 4	6		0.026	SCAR scrap
BR3-319	0.955		0.18	0.10	0.034		5 X 2.75	196	200	0.056	2.75" scrap, mostly Al
BR3-320	0.972		0.03	0.00	0.056		8.5 X 11.5	324	340	0.042	ordnance scrap
BR3-322	0.918		0.05	0.04	0.030		5.5 X 3.5	75	60	0.119	2.75" W.H. scrap
BR3-328	0.980		0.01	0.00	0.049		5.75 X 8.25	44	50	0.152	ordnance scrap
BR3-347	0.832	surface target, strong EM	0.00	0.00	0.044	0.057		355	345	0.253	SCAR scrap
BR3-361	0.887	small target near the surface	0.07	0.04	0.035		4.5 X 4.75	346	340	0.028	spotting charge can, M 38
BR3-362	0.953	very small target	0.05	0.05	0.027	0.181		18	25	0.066	7" of wire
BR3-363	0.796	small target of 18"	0.55	0.06	0.071		5.75 X 1.75	352	350	0.158	2.75" rocket W.H. scrap
BR3-364	0.890	small target at 1'	0.35	0.20	0.047		7 X 6	17	20	0.104	2.75" rocket W.H. scrap
BR3-366	0.992	likely M38	0.63	0.48	0.168	0.057		354	0	0.053	SCAR, intact
BR3-367	0.758	fins from target 366	0.13	0.11	0.044		3.75 X 3.75	190	180	0.071	ordnance scrap
BR3-368	0.969	small target at 2'	0.63	0.64	0.079	0.070		24	20	0.093	2.75" W.H., intact
BR3-369	0.992	small target near surface	0.08	0.09	0.043			331	340	0.115	pair of pliers
BR3-375	0.934	very small target near surface	0.08	0.05	0.037	0.229		62	75	0.024	12" of wire

Table 11. Continued

Target ID	Fit Quality	DAS Analyst Comments	Depth (m) Fit	Depth (m) Reported	Target Size Ordn. Fit	Target Size Ordn. Reported	Target Size Scrap Reported (in)	Azimuth Fit	Azimuth Reported	Miss Distance (m)	UXO Remediation Comments
BR3-377	0.961	small target at 1'	0.33	0.20	0.045		4.5 X 7	154	160	0.173	2.75" rocket base
BR3-378	0.971	medium target at 2'	0.68	0.56	0.082	0.070		12	358	0.097	2.75" W.H., intact
BR3-379	0.940	small target at 1'	0.30	0.15	0.051		4.25 X 1.25	301	300	0.195	2.75: scrap
BR3-380	0.949	small target at 1.5'	0.43	0.33	0.054		6 X 5	73	75	0.132	2.75" scrap
BR3-381	0.985	likely M38	0.36	0.30	0.127	0.070		4	10	0.088	SCAR parts
BR3-382	0.997	surface target	0.06	0.00	0.055		8.625 X 7.375	5	10	0.037	ordnance scrap
BR3-383	0.982	likely mashed M38	0.42	0.34	0.114	0.057		18	25	0.085	SCAR, intact
BR3-384	0.987	surface target	0.02	0.00	0.055		4.5 X 11.5	358	350	0.081	ordnance scrap
BR3-385	0.927	small target at 1'	0.35	0.25	0.045		6.5 X 2.5	83	70	0.174	2.75" W.H. pieces
BR3-386	0.979	likely M38	0.38	0.41	0.178	0.203		304	300	0.078	M 38 with fins
BR3-388	0.962	surface target	0.04	0.04	0.040		6 X 6.25	292	290	0.054	ordnance scrap
BR3-389	0.938	surface target	0.18	0.15	0.041		5 X 3.125	137	140	0.028	Prince Albert Tobacco Can
BR3-397	0.991	likely M38	0.43	0.43	0.158	0.305		321	330	0.077	M 38, deformed
BR3-398	0.969	small target near surface	0.08	0.05	0.041	0.260		347	340	0.099	10" of wire
BR3-399	0.873	small target at 2'	0.79		0.068			6			Dry Hole
BR3-402	0.987	likely M38, inverted signal	0.78	0.69	0.160	0.432		261	335	0.153	M 38, deformed

Table 11. Continued

Target ID	Fit Quality	DAS Analyst Comments	Depth (m) Fit	Depth (m) Reported	Target Size Ordn. Fit	Target Size Ordn. Reported	Target Size Scrap Reported (in)	Azimuth Fit	Azimuth Reported	Miss Distance (m)	UXO Remediation Comments
BR3-403	0.825	small target near surface	0.14	0.01	0.054			356		0.096	50 Cal. Ammo. Link
BR3-404	0.989	small target near surface	0.03	0.00	0.047			328	270	0.128	M 38 fin
BR3-405	0.986	small target near surface	0.04	0.00	0.035			331		0.037	M 38 fin
BR3-406	0.994	large for an M38	0.41	0.53	0.220			339	350	0.084	M 38
BR3-407	0.985	small target near surface	0.08	0.00	0.041			302		0.031	ordnance scrap
BR3-408	0.925		0.02	0.00	0.123			1	270	0.433	M 38 fin assembly
BR3-409	0.976	likely M38	0.35	0.04	0.178			275	0	0.097	M 38
BR3-410	0.955	surface target	0.04	0.00	0.044	0.108		84		0.078	M 38 fuse assembly
BR3-411	0.973	surface target	0.01	0.00	0.051		8 X 6.5	348		0.050	M 38 Fin
BR3-412	0.777	surface target	0.07	0.00	0.035		7.5 X 4.25	16		0.480	metal strap
BR3-413	0.922	small target at 1.5'	0.57	0.00	0.081	0.070		351	340	0.049	2.75" W.H. intact
BR3-416	0.984	small target at 1'	0.37	0.36	0.079	0.070		14	5	0.007	2.75" W.H. intact
BR3-417	0.976	surface target	0.02	0.01	0.052		7 X8.25	345	355	0.076	ordnance scrap
BR3-418	0.882	surface target	0.01	0.00	0.037		8.5 X 6.5	6	10	0.019	ordnance scrap
BR3-419	0.987	surface target	0.01	0.00	0.086		10.5 X 9.125	296	300	0.044	ordnance scrp
BR3-420	0.985	surface target	0.08	0.06	0.048		5 X 1.875	328	340	0.030	2.75" rocket base

Table 11. Continued

Target ID	Fit Quality	DAS Analyst Comments	Depth (m) Fit	Depth (m) Reported	Target Size Ordn. Fit	Target Size Ordn. Reported	Target Size Scrap Reported (in)	Azimuth Fit	Azimuth Reported	Miss Distance (m)	UXO Remediation Comments
BR3-421	0.954	small target at 10"	0.27	0.22	0.068	0.070		356	350	0.049	2.75" W.H. intact
BR3-422	0.974	likely M38	1.18	1.10	0.163	0.057		13	20	0.295	SCAR
BR3-423	0.987	likely M38	0.30	0.46	0.173	0.305		285	300	0.121	M 38
BR3-425	0.949	surface target	0.04	0.00	0.058		4.25 X 8	323	338	0.121	Ordnance scrap
BR3-426	0.992		0.04	0.00	0.056		8.75 X 6	333		0.088	M 38 Fin
BR3-427	0.970		0.13	0.03	0.041		7.25 X 8	286		0.002	M 38 fin
BR3-428	0.929		0.10	0.03	0.067	0.070		255	10	0.124	2.75" W.H., intact
BR3-431	0.989		0.03	0.00	0.036		6 X 4.5	345		0.022	SCAR Fin
BR3-432	0.967		0.09	0.03	0.053		10 X 5.5	248	40	0.017	M 38 Fin
BR3-433	0.990	target is very near a large practice bomb	0.55	0.56	0.195	0.241		261	340	0.061	M 38 with armed charge
BR3-434	0.951	target is likely associated with #433	0.06	0.00	0.038		6.4 X 4.25	334		0.021	SCAR fin
BR3-435	0.899		0.07	0.03	0.042	0.165		321		0.061	Steel Frag.
BR3-436	0.984		0.05	0.00	0.058		10.5 X 10.5	17		0.037	M 38 Fin
BR3-437	0.905		0.00	0.00	0.039		3 X .5	329		0.909	metal strap, 3"
BR3-438	0.953		0.25	0.20	0.042	0.508		293	55	0.146	20 mm projectile
BR3-439	0.959		2.54		0.192			14			Dry Hole, dug to 10.5"

Table 11. Continued

Target ID	Fit Quality	DAS Analyst Comments	Depth (m) Fit	Depth (m) Reported	Target Size Ordn. Fit	Target Size Ordn. Reported	Target Size Scrap Reported (in)	Azimuth Fit	Azimuth Reported	Miss Distance (m)	UXO Remediation Comments
BR3-440	0.916		0.09	0.03	0.030	0.102		293		0.027	M 38 fuse assembly
BR3-441	0.956		0.11	0.08	0.048		6.5 X 6	258		0.047	M 38 fin
BR3-442	0.954		0.00	0.00	0.046	0.267		291		0.023	M 38, case piece
BR3-443	0.984	likely M38	0.51	0.43	0.164	0.330		287	275	0.312	M 38, deformed
BR3-461	0.990		0.04	0.00	0.039		8 X 2.5	329		0.054	M 38, case scrap
BR3-462	0.952	Remnant Magnetization	0.08	0.00	0.064		7.5 X 3	240		0.054	M 38 fin
BR3-463	0.933		0.03	0.00	0.055		9.25 X 5.5	8	0	0.039	M 38 fin
BR3-464	0.848		0.11	0.05	0.060		7 X 9.25	329	110	0.042	M 38 fin
BR3-465	0.961		0.06	0.00	0.041		8.5 X 7.25	303	22	0.056	M 38 fin
BR3-466	0.973	Remnant Magnetization	0.25	0.24	0.060	0.070		206	205	0.083	2.75" W.H. pristine
BR3-468	0.928	large for a practice bomb, dig this	0.47	0.46	0.256	0.254		113	318	0.357	M 38, intact with charge
BR3-469	0.979	Remnant Magnetization, practice bomb	0.44	0.33	0.195	0.254		231	5	0.120	M 38, deformed
BR3-470	0.984	Remnant Magnetization	0.05	0.03	0.041		4.75 X 5.5	271		0.013	M 38 fin
BR3-471	0.983		0.28	0.30	0.060	0.057		255		0.182	2.75" W.H. Parts
BR3-472	0.921	Remnant Magnetization	0.07	0.05	0.076		6.5 X 8.5	262		0.043	Steel & Al Ordnance Scrap
BR3-474	0.884	small target on surface	0.00	0.00	0.074		9.5 X 9	23	25	0.087	ordnance scrap

Table 11. Continued

Target ID	Fit Quality	DAS Analyst Comments	Depth (m) Fit	Depth (m) Reported	Target Size Ordn. Fit	Target Size Ordn. Reported	Target Size Scrap Reported (in)	Azimuth Fit	Azimuth Reported	Miss Distance (m)	UXO Remediation Comments
BR3-475	0.879	small target on surface	0.00	0.00	0.053	0.241		170	180	0.128	ordnance scrap
BR3-476	0.937	small target on surface, note bomb 3m south	0.00		0.034			355			Dry Hole
BR3-478	0.894	small target on surface	0.00	0.01	0.037		6 X 3.5	64	80	0.108	ordnance scrap
BR3-479	0.933	small target on surface	0.00	0.00	0.061		6 X 5.5	340	340	0.067	frag pieces
BR3-480	0.984	small target on surface, strong EM signature	0.05	0.06	0.042		5 X 2.25	41	35	0.004	ordnance scrap
BR3-481	0.973	small target on surface	0.03	0.04	0.043		7.25 X 7.5	341	320	0.025	ordnance scrap
BR3-482	0.871	small target near surface	0.07	0.04	0.044		2 X 6.5	121		0.056	ordnance scrap
BR3-483	0.959	small targ at surface	0.05	0.05	0.047		10 X 5	328		0.150	M 38 fin
BR3-484	0.907	small targ on surface, this is a good EM target	0.01	0.00	0.060		8.5 X 6.75	342	270	0.159	M 38 fin
BR3-486	0.885	EM targ 44	0.27	0.25	0.032	0.076		209		0.061	steel & al scrap from 2.75"
BR3-487	0.823	EM targ 42, small targ on surface	0.00	0.00	0.034		6 X 4.75	266		0.191	M 38 fin
BR3-488	0.729	Strong EM targ 40	0.04	0.05	0.025	0.070		286	115	0.103	2.75" venturi
BR3-489	0.815	EM targ 43	0.50	0.46	0.044	0.070		302	357	0.261	2.75" venturi
BR3-490	0.950	mag targ on surface	0.04	0.03	0.050		6 X 8	262		0.063	3 pieces of scrap
BR3-491	0.991	small targ on surface	0.05	0.05	0.047	0.127		257		0.040	Fin
BR3-492	0.971	small targ on surface	0.01	0.03	0.046	0.095		227		0.024	scrap

Table 11. Continued

Target ID	Fit Quality	DAS Analyst Comments	Depth (m) Fit	Depth (m) Reported	Target Size Ordn. Fit	Target Size Ordn. Reported	Target Size Scrap Reported (in)	Azimuth Fit	Azimuth Reported	Miss Distance (m)	UXO Remediation Comments
BR3-493	0.955	small targ near surface	0.13	0.05	0.041	0.102		196		0.045	firing assembly for M38
BR3-495	0.923	EM TARGET #4, small target at 18"	0.43	0.36	0.045		8 X 8.75	25		0.067	2.75" scrap
BR3-E003	0.813	Very weak Mag signature	0.28	0.14	0.061	0.070			350	0.158	2.75" scrap
BR3-E011	0.899	Small Mag signature, dig this	0.38	0.38	0.071		4 X 3.5			0.069	Al ordnance scrap
BR3-E028	0.888	Very weak Mag	0.60		0.071					0.195	2.75" Al scrap
BR3-E029	0.921	Very weak Mag	0.22	0.13	0.049					0.259	2.75" scrap
BR3-E030	0.760	Weak Mag signature	0.24	0.23	0.052					0.181	2.75" venturi
BR3-E031	0.903	No Mag signature	0.00	0.00	0.093	0.343				0.067	Al wire
BR3-E035	0.902	Small near-surface target, weak Mag	0.00	0.00	0.032	0.070				0.053	2.75" Al scrap
BR3-E036	0.768	No (or very weak) Mag signature	0.16	0.15	0.043		1.25 X 1.25			0.232	Al fin
BR3-E038	0.857	Near-surface trash, peculiar Mag signature	0.00	0.00	0.049		8.5 X6.5			0.105	M 38 fin
BR3-E041	0.795	Near-surface, no Mag	0.00	0.00	0.028					0.195	2.75" Al scrap
BR3-E059	0.861	Near-surface, weak Mag	0.00	0.02	0.031	0.070				0.140	2.75" scrap
BR3-E060	0.745	Possibly between two weak Mag signals	0.64	0.44	0.074	0.057				0.293	2.75" Al scrap
BR3-E062	0.707	Near-surface, no Mag	0.00	0.00	0.031		12 X 1.5		45	0.176	2.75" Al scrap
BR3-E063	0.744	Weak Mag (two dipoles; one inverted)	0.70		0.090						Dry Hole

Table 11. Continued

Target ID	Fit Quality	DAS Analyst Comments	Depth (m) Fit	Depth (m) Reported	Target Size Ordn. Fit	Target Size Ordn. Reported	Target Size Scrap Reported (in)	Azimuth Fit	Azimuth Reported	Miss Distance (m)	UXO Remediation Comments
BR3-E066	0.960	EM TARG NOT MARKED IN MAG	0.00	0.00	0.053		7 X 6			0.112	M 38 fin
BR3-E067	0.854	EM TARG NOT IN MAG	0.65	0.48	0.090					0.240	2.75" al scrap
BR3-E068	0.889	EM TARG	0.00	0.06	0.045	0.070			300	0.149	2.75" W.H. , intact
BR3-E069	0.615	EM TARG	0.00	0.00	0.034		10 X 4		280	0.475	M 38 fin
BR3-E073	0.727	no mag signature, add to dig list	0.00	0.00	0.039		8.5 X 2.25		65	0.074	2.75" al scrap
BR3-E078	0.780	not in mag add to dig list	0.35		0.083						Dry Hole
BR3-E087	0.879	no mag targ, dig this	0.00	0.00	0.038		2.875 X 3.75		120	0.239	2.75" Al scrap
BR3-E093	0.913	not in mag, dog this	0.00	0.12	0.053		7.5 X 8.5		100	0.117	ordnance scrap
BR3-E097	0.897	not in mag, dig this	0.44	0.04	0.082	0.057			95	0.218	ordnance scrap
BR3-E166	0.824	1.5m NE of mag targ 63, dig this	0.12	0.05	0.070	0.102			320	0.033	2.75" W.H. parts
BR3-E180	0.157	THERE IS NO MAG SIGNATURE, DIG THIS	0.00	0.00	0.021		8.25 X 3.375			0.168	2.75" al scrap
BR3-E182	0.675	THERE IS NO MAG SIGNATURE, DIG THIS	0.38	0.28	0.056		3.25 X 1.625			0.021	2.75" Al scrap
BR3-E186	0.681	WEAK MAG SIGNATURE, DIG THIS	0.60	0.38	0.093	0.178				0.197	2.75" Al scrap
BR3-E188	0.934	THERE IS NO MAG SIGNATURE, DIG THIS	0.00	0.00	0.054		4 X 16.5			0.083	2.75" al scrap
BR3-E189	0.514	THERE IS NO MAG SIGNATURE, DIG THIS	0.63	0.43	0.080	0.076				0.092	2.75" al scrap
BR3-E195	0.881	LARGE EM TARGET WITH NO MAG SIGNATURE, DIG THIS	0.00	0.00	0.097	0.356				0.021	Al scrap